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PATHOLOGY AND CLINICAL SIGNIFICANCE OF STOMACH ULCER

FROM A STUDY OF THE MATERIAL FROM 216 PARTIAL GASTRECTOMIES FOR ULCER, ULCER AND CARCINOMA, AND CARCINOMA

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IN the history of the study of ulcer another period may be recorded, and that is, the observation of ulcer in the living individual as seen at operation and immediately after removal. With the improvement of legal right and individual submission to more scientific examination, trained observation, and surgical dexterity, our knowledge has increased in a systematic and orderly manner until to-day we are in a better position to confirm and add to the remarkable observations and records of Baillie, Abercrombie, Cruveilhier, Morgagni, Rokitansky, Müller, Heitler, Waldeyer, Hauser, Welch, and others in passing successively from purely autopsy findings, and autopsy and clinical findings, to the immediate examination of early ulcers during and after resection.

The cases herewith presented are a part of the material examined freshly within two minutes after removal from two hundred and sixteen resections of the stomach for ulcer, ulcer and carcinoma, or carcinoma, in the clinics of Drs. W. J. and C. H. Mayo.

The material divides itself grossly and microscopically into three groups. These groups comprise two hundred and sixteen cases, fifty-eight of which are ulcers, one hundred and twenty-five ulcer and carcinoma, and thirty-three carcinoma without any good evidence of ulcer. The last two groups will be considered in this paper. Group one comprises cases which, at operation, were ulcers which were resected for ulcer with possibly carcinomatous borders. Upon examination, grossly and microscopically, no evidence of carcinoma was found. Group two is considered here because the specimens present all the characteristics of ulcer grossly and microscopically, with the additional feature that the borders contain definite areas of carcinoma microscopically. Specimens in this group show the base of the ulcer free from carcinoma and consisting only of granulation and scar tissue. In order to show that up to the present time we cannot say absolutely that all gastric carcinomata develop on ulcer and that some ulcers do show carcinomatous remnants in the base, and may be ulcerated primary carcinomata, it may be well to show some advanced cases of ulcer and carcinoma. From the pathological standpoint during the observations the following questions arose:

What is the life history of gastric ulcers, e. g., how do they begin, progress, and terminate? What are the gross and microscopical characteristics, and how do they differ from the so-called ulcerated, gastric carcinomata?

From a clinical diagnostic standpoint: Can one be sure that one is dealing with the simple ulcer, and what are the chances for its not being a simple ulcer? From a therapeutic

Fig. 1. (Case No. 18088.) Multiple gastric ulcers.

standpoint: In a case with a typical ulcer history what are the chances that the medical or hygienic measures are combating a condition which we know is certainly incurable by such measures? At operation what are the difficulties in making a differential diagnosis between a benign ulcer and a malignant ulcer?

Technique. Immediately after the removal of the specimens, frozen sections were made and stained with Unna's polychrome methylene blue. With this method[1] a more accurate and more beautiful picture may be had than by staining with hæmatoxylin and eosin. They contain less artifacts than would be expected, and do occur after hardening in formalin, dehydrating in alcohols, and clearing in the various clearing fluids.

Blocks were taken from every specimen and hardened in ten per cent formalin, twenty-four hours, frozen, cut, and stained with hæmatoxylin and eosin for comparison and record. The gross specimens were fixed according to Melinkow's modification of Kaiserling's method of preserving color or in ten per cent formalin.

CASE No. 18088 (Figs. 1 to 8). A male, aged forty-five, who twenty years ago had three attacks of inflammation of the bowels, during a period of nine months, and was in bed about a week with each attack. He had severe pain over McBurney's point lasting three days. This was severe enough to cause vomiting. The point

[1] Wilson, Journal American Medical Association, December 2, 1905.

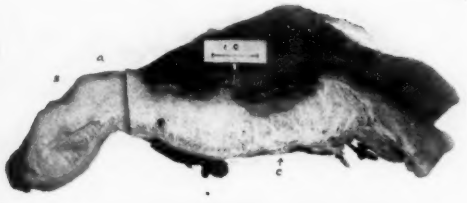

Fig. 2. (Case No. 18088.) Gross section through four of the ulcers showing various degrees of extension of the process of erosion into the coats of the stomach wall.

was tender, the soreness lasting about three days after patient was out of bed. Four years ago he had some pain and soreness, especially after exertion. About seven or eight months ago there was again tenderness over McBurney's point; it came on at eleven A. M. and four to five P. M., and continued until salty water ran out of the mouth. The patient would then vomit; the vomitus was sour and bitter, four months ago it became bloody. Three days ago a tumor was noticed in the epigastrium. His weight decreased sixty pounds. He complained of gas one to two hours after meals. Belching of this gas gave no relief. The pain often radiated to the loin. At operation three-fourths of the stomach and the lesser curvature were resected for cancer and multiple ulcers. The resected portion contains five simple ulcers and one malignant ulcer varying in size from 3 mm. to 2½ cm. in diameter. The largest of these (Fig. 1,2, c) ulcers is about one-half cm. in depth, and has a base which extends partially through the muscularis and is covered to the extent of one-half mm.with necrotic tissue. The next largest ulcer which is 2 mm. in depth, does not extend to the muscularis, but rests upon a chronically inflamed submucosa, which is composed of dense scar tissue. The ulcer

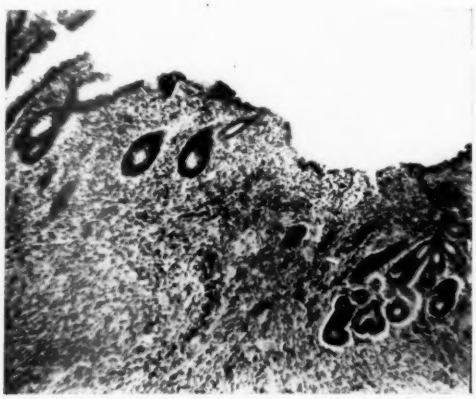

Fig. 3. (Case No. 18088.) Microphotograph through ulcer (a) Figs. 1 and 2.

(b) is 2 mm. in depth and 6 mm. in diameter and rests upon a chronically inflamed submucosa. There is no apparent hypertrophy of the mucosa, but it does project over the edge of the ulcer cavity. The bases of the two larger ulcers are composed of dense connective tissue, along the surface of which are found lymphocytes and necrotic connective tissue. Throughout this connective tissue mass and extending into the mucosa are numerous aggregations of lymphoctytes. There is no evidence in the mucosa of any irregularity in the glandular arrangement; however, a few of the cells of the individual glands show marked irregularity in size. These, however, cannot be said to be carcinoma. In no portion of the border of any of the ulcers is there any trace of epithelium dipping below the mucosa into the submucosa. The nuclei are apparently regular in shape and size in all areas examined, excepting the one small area described above. The smallest ulcer (Fig. 1, 2a, 3) does not extend below a depth greater than half that of the mucosa. Epithelial cells or remnants of glands may be seen in the base of this ulcer. The base is composed of dense connective tissue, which extends through the mucosa and submucosa. The muscularis mucosæ is almost completely intact, with narrow strands of connective tissue penetrating it. The glands in the border of this small ulcer are regular in shape, and have nuclei which show no irregularities. The mucosa is infiltrated with lymphocytes in great numbers. One centimeter from the border of the ulcer is a definite chronic gastritis.

In this specimen we have "erosions" in various stages, from a partial destruction of the mucosa to complete destruction of the mucosa and involvement of the muscularis. Whether or not the gastritis seen in the mucosa bordering the ulcers is secondary to the condition which caused the ulcer, or is primary to the erosion

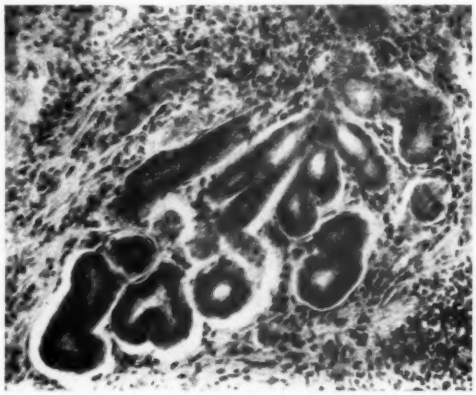

Fig. 4. (Case No. 18088.) High power microphotograph through the base of ulcer (a) Figs. 1, 2, and 3.

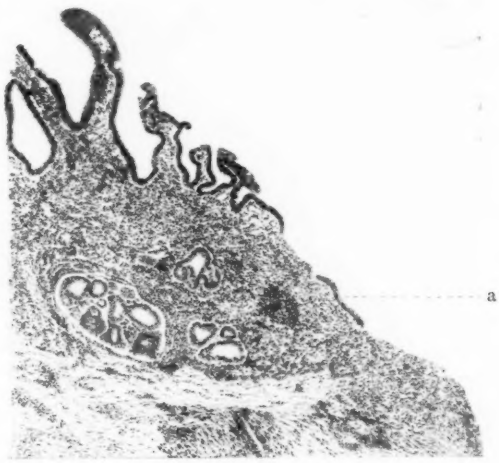

Fig. 5. (Case No. 18088.) Border of ulcer (b) in Figs. 1 and 2. (a) Apparent attempt to replace the lost epithelium.

is difficult, perhaps impossible to determine, the connective tissue elements apparently being of the same age and structure.

Case No. 28173 (Figs. 9, 11), a male aged fifty-five. Four years ago he had "stomach trouble" with distress and belching of sour fluid and gas. For one year the patient's trouble was mild and then the pain became severe in the epigastrium and extended through to the back and left shoulder, but was more severe in the back. These pains came on two to four hours after meals, and were relieved by forced vomiting. The distress was also relieved by food or soda. There was never obstructive vomiting. The condition would be improved for a few weeks and worse for a couple of months. The pains grew gradually more severe. His appetite was good, his bowels were regular, and there was no jaundice. Loss of weight 15 pounds. Gastric analysis showed a total acidity of 70, free HCl 50, and combined HCl 10. The feces contained blood. The resected portion of the stomach is about 5 cm. in diameter and contains an ulcer 8 mm. in diameter. There is no gross evidence of hypertrophy of the border. A section through the center shows a conically-shaped erosion, at the base of which there is extensive connective tissue proliferation which radiates from the base, and which was apparently adherent to some neighboring organ. Grossly there is no sign of carcinoma. The erosion penetrates the muscularis and the scar tissue extends through the whole wall. Upon microscopical examination, the base is found to consist of scar tissue, which is necrotic on its internal surface, but without new blood-vessel formation. There are extensive aggregations of lymphocytes along the necrotic border, the lymph spaces are filled with lymphocytes and radiate from the center of the ulcer.

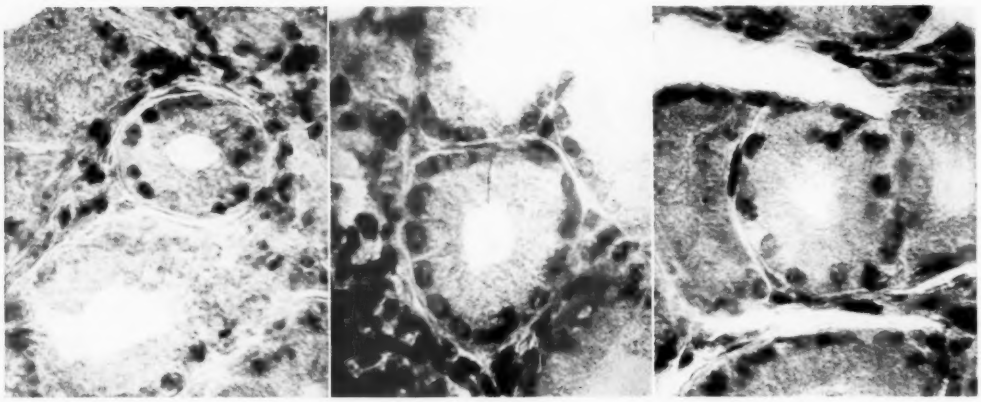

Fig. 6. Fig. 7. Fig. 8.

Figs. 6, 7, and 8. (Case No. 18088.) Microphotograph showing the regularity of the deeper glands of the mucosa in the borders of the ulcers.

The base of the ulcer shows no signs of glandular elements. The border of the mucosa is markedly infiltrated with lymphocytes. The nuclei of the glands are round and show no irregularity in form. There are no microscopical signs of carcinoma in the specimen.

CASE No. 25692 (Figs. 12, 13), a male, aged sixty, who came for consultation complaining of having suffered from shortness of breath and spells of pain, associated with vomiting of sour material. This was often relieved by food for three to five hours. At times the attacks became worse; milk and hot water at night eased the pain. There was no history of acute perforation. Tenderness was present over an epigastric area the size of the hand. During the past eighteen months he has used the stomach tube practically every day, and obtained some blood at times. He has had steady pain for two to three years. Appetite good, bowels sluggish. Gastric analysis showed a total acidity 70, free hydrochloric acid 52, combined hydrochloric acid 14, and food remnants. Hæmaglobin 82 per cent. At operation the pyloric end of the stomach was resected for perforating ulcer. This specimen contains an ulcer 1 cm. in diameter and about 7 mm. in depth. The mucosa overhangs the ulcer and is composed of glands, between which is an infiltration of lymphocytes. The nuclei of the glands are regular in size and do not show mitotic figures. The mucosa is sharply marked off from the submucosa. The base of the ulcer is composed of connective tissue containing masses of lymphocytes and remnants of glands. The nuclei of these glands remnants are small, round, and do not show any mitotic figures. A gross section through this ulcer shows a perforation of all the coats of the stomach by dense connective tissue.

CASE No. 27381 (Fig. 14). A male, aged thirty-four, who has had almost constant distress in stomach region for thirteen years. For four months at one time he had relief, the rest of the time distress, pain, gas, and sour vomiting occurred two to four hours after meals. Food or vomiting relieved this pain. The vomitus never contained blood. Loss of weight 45 pounds. There is a note in the history that the patient gives "a steady ulcer history." The pains were very severe but never prolonged. Gastric analysis revealed a total acidity of 42, free hydrochloric acid 25, and combined hydrochloric acid (questionable). At operation a chronic perforating ulcer of the lesser curvature, the size of a dime, was found. It had perforated into the head of the pancreas. The specimen is an ulcer of the lesser curvature 5 mm. in diameter and 5 mm. in depth. The base is composed of scar tissue and has a necrotic inner border filled with lymphocytes and leucocytes, and shows no evidence of new blood-vessel formation. There are no epithelial elements in the base. Aggregations of lymphocytes are present throughout the submucosa. The border of the mucosa is infiltrated with lymphocytes and leucocytes. There are no new formed capillaries in this border. The glands are composed of cells with round nuclei, which do not show mitotic figures, or any irregularity in size or shape. Between the cells large numbers of leucocytes are seen. No carcinoma is to be seen in the specimen.

CASE No. 30163 (Fig. 15). Female, aged thirty-nine, who was in bed four weeks with "inflammation of the bowels" about nineteen years ago. About two years ago severe pain in the epigastrium and sour belching occurred one and one-half to two hours after meals. Food gave no relief. There was soreness to the left of the vertebral columns during these attacks. Later she began to vomit. This condition became gradually worse and three or four years ago she began taking hospital starvation cure, which improved her condition. Her appetite was fair, her bowels were regular, but there was some loss in weight. Soda often relieved the pain temporarily. At the time of the patient's visit the pain came on two to three hours after meals, associated with much gas and distress which was relieved by vomiting and food. Gastric analysis showed

a total acidity of 52, free hydrochloric acid 38, combined hydrochloric acid 14. At operation there was found an ulcer 1 cm. in diameter and one-half cm. in depth upon the lesser curvature of the stomach. The complete ulcer was resected and examined immediately for carcinoma. It, however, shows only a deep erosion to the muscularis and a base in which there is an extensive infiltration with lymphocytes and scar tissue. In the base there is no evidence of glandular elements. In the immediate border of the mucosa, which projects over the edge of the ulcer, is an infiltration with round cells but no apparent hypertrophy of the glands. The glands themselves are regular in contour and are composed of cells with perfectly round or oval nuclei, showing no irregular mitotic figures or signs of regular or irregular hyperplasia. There are therefore no signs of carcinoma in the border. The base shows no evidence of granulation tissue. There are no new formed blood-vessels. It is simply a necrotic base. The lymph spaces extending from the border in the submucosa and muscularis are filled with lymphocytes.

Case No. 30040 (Fig. 16), is a male, aged forty, who for ten years has had attacks of pain in the upper abdomen. At first these were not severe and were of short duration. The last three or four years these attacks became more frequent and more severe. They lasted from a month to two months, and occurred periodically with intermissions of about a month. During the periods of attack the pain was present every day, lasting one to two hours, and was severe enough to cause vomiting. The patient, at the time of consultation, was able to eat everything, but had considerable gas and had lost 30 pounds in the last three years. Food relieved pain for about an hour. He has never vomited bile or blood, but complained of sour eructations. Gastric analysis showed a total acidity of 58, free hydrochloric acid 40, combined hydrochloric acid 18, and blood present. At operation an ulcer of the posterior wall of stomach one and one-half inches below the cardia, and the size of a silver three-cent piece was resected. The ulcer is 6 cm. in diameter and 3 mm. in depth. The base is composed of scar tissue and necrotic material composed of lymphocytes and leucocytes, and shows no new blood-vessel formation, and no glandular elements. The border of the mucosa which overhangs the connective tissue border, is infiltrated with lymphoctytes,and is composed of glandular elements which show evidence of hyperplasia. The nuclei are round and oval and almost uniformly regular in shape but irregular in size. There are aggregations of lymphocytes throughout the subbasal tissue.

Case No. 27919 (Figs. 17, 18), a male, aged fifty-three, who, at his first visit to the clinic, November, 1906, for two or three months had had occasional pain and ache from two to three hours in the gall-bladder region. This was associated with some gas and distress in stomach when he ate liberally. His appetite was good. The laboratory findings were negative. Ten years ago the patient had sour eructations and pain over liver three hours after meals. October 24, 1908, appetite was good; about three hours after food was taken he began to feel distress in epigastrium with sour eructations; always has gas and occasional vomiting, less than once a week. Soda, alkalies, eating, and irrigation gave relief. He had irrigated his stomach almost daily for years past. Recently he noticed food remnants in the washings. The gastric analysis showed a total acidity of 64, free hydrochloric acid 30, combined hydrochloric acid 14, fatty acids, and food remnants. A second gastric analysis two days later showed a total acidity of 90, free hydrochloric acid 28, combined hydrochloric acid 30, fatty acids, and food rem-

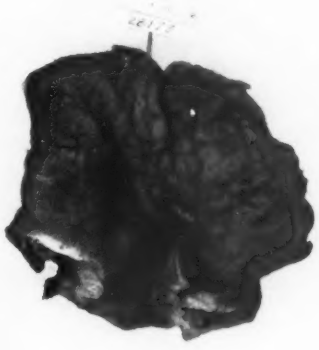

Fig. 9. (Case No. 28173.) Single gastric ulcer.

Fig. 10. (Case No. 28173.) Gross sections through the ulcer showing extension through all the coats of the stomach wall.

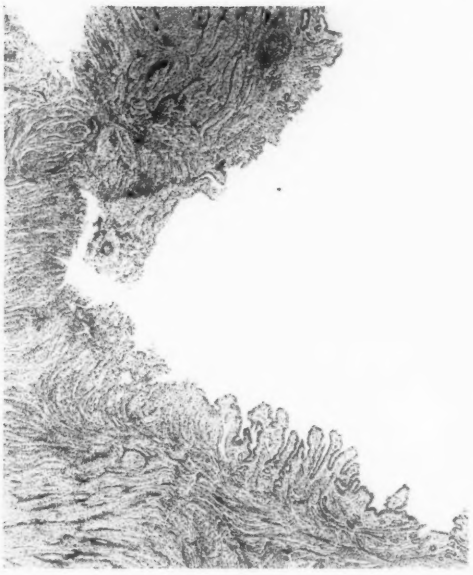

Fig. 11. (Case No. 28173.) Section through the ulcer showing the character of the border and the necrotic scar tissue base.

nants. At operation two ulcers at the pyloric end of the stomach on the posterior wall, one and one-half inches above pylorus were found. One was carcinoma. The specimen consists of a resected portion of the stomach, containing two shallow ulcers, each ulcer about 1½ cm in diameter and about 3 mm. in depth. They have not penetrated the muscularis. There is an increase in the connective tissue of the submucosa, but this increase does not extend to the muscularis. The glands of the mucosa are regular in shape and have nuclei which are round and show no irregular hyperplasia. The base of both ulcers consists of scar tissue. Beneath the mucosa in the scar tissue are islands of irregular epithelial elements. These small masses of carcinomatous tissue appear to have grown into the scar mass from the immediate edge of the ulcer below the inflammatory mucosa. The mucosa is infiltrated with lymphocytes with only occasional remnants of glands, the nuclei of which show mitosis and irregularity in size The epithelial islands below the mucosa in this fibrous mass are typical epithelial glands, with the exception that they are irregular in form, and that the cells are irregular in size and show irregular mitosis.

Case No. 21555 (Figs. 19 to 24 inclusive). A male, aged sixty-seven, who thirty-five years ago had dyspepsia, but nothing severe, and from then until two years ago had no trouble. At this time he began to have pain, associated with gas and sourness when his stomach was empty. He became gradually worse until four months ago when he began to vomit "sour stuff" and belch gas. He complained of distress in the epigastrium. There was "coffee grounds" vomitus at this time. In two years he had lost 35 pounds in weight, and most of this has occurred during the last four months. The gastric analysis showed hyperacidity and lactic acid present. One-third of his stomach was resected. The specimen contains an oval-shaped ulcer 3 cm. in its long diameter, about 1½ cm. in the short diameter, and 1 cm. in depth. A section through the ulcer shows that the base is infiltrated with lymphocytes and composed of connective tissue, which extends through the muscularis and peritoneum. The inner surface is necrotic and contains no epithelial elements, but here and there aggregations of lymphocytes. At a point just below the border is a definite area of perverted epithelium. This area grossly is definitely marked out from the rest of the base, and is the only area which shows carcinoma. It is definitely connected with the border of the mucosa and seems to be an outgrowth from it, which is itself composed of irregular hyperthrophic glands, between which is an extensive infiltration with lymphocytes. The epithelial nuclei of this portion of the border are irregular in shape and size.

This case is of great importance because in it we have the exact picture of ulcer as seen in the foregoing cases, with the addition of a definite area of carcinoma situated below the mucosa of the border, and definitely connected with the glands of the same, showing that this area is most probably an outgrowth of the glands in the border of an ulcer, rather than a remnant of an ulcerating carcinoma.

Case No. 24527 (Figs. 25, 26). Male, aged fifty-three, who was examined on January 7, 1908, and who had complained for five months of vomiting, nearly every night for the past month, about bedtime. He

Fig. 12. (Case No. 25692.) Gross section through a single gastric ulcer.

had been eating three meals daily and felt no inconvenience through the day, but complained of gas between 8 P. M. and midnight, when he vomited a large quantity of partially digested food. He then felt comfortable until the next night. He has had no severe pain but has had some loss of appetite. There was no blood in the vomitus. He was always well until August. Hæmaglobin 67 per cent. Gastric analysis revealed a total acidity of 60, free hydrochloric acid 20, combined hydrochloric acid 20, fatty acid, but no blood. One-half of the stomach was resected. The resected portion contains a shallow ulcer about 4 or 5 cm. in diameter, and about 2 mm. in depth. The surface of the base is smooth and the mucosa gradually diminishes in thickness toward the base. A gross section shows that it has perforated all walls of the stomach and is infiltrated with carcinoma. Microscopically, one sees an eroded base containing carcinomatous tissue. The mucosa of the border is also extensively involved.

In this specimen we have an erosion of the mucosa and an involvement of all the coats of the stomach under the ulcer by carcinoma. It is impossible to say whether this ulceration was due primarily to carcinoma, or whether the carcinoma was due to an ulceration.

Case No. 16651 (Figs. 27, 28). Female, aged forty-two, who sixteen years ago, five days after a confinement, was washing clothes, at which time she had a severe cramp in "stomach." During that summer she had cramps, which lasted from one hour to a day. Toward fall of the same year she began to vomit immediately or about two hours after meals. This vomitus was not sour, there was no blood and no pain. She had no gas from stomach until this last summer. Bowels usually regular. These same spells lasted until four or five years ago and then began to be less severe. For two years previous to last July she was perfectly well, ate everything, was hearty, strong, and worked steadily, weighed 142 pounds. Then she began to lose her appetite and felt weak and tired.

There was no pain. In August she began to belch as soon as food was taken; often the vomitus contained a previous meal. A tumor was palpable in the epigastrium. Hæmaglobin 27 per cent. Gastric analysis showed a total acidity of 50, no free hydrochloric acid, combined hydrochloric acid 5, lactic acid, blood, and fatty acids. At operation about three-fourths of the stomach were resected. The specimen contains an ulcer about 2 cm. in diameter and one-half cm. in depth, with a border which overhangs about 3 mm. Upon gross section, there is a connective tissue proliferation extending from the base to the peritoneum. The former rests upon the lower half of the musculature, through which it has almost completely eroded. In the base one sees grossly and microscopically carcinomatous areas, some of which have become partially eroded.

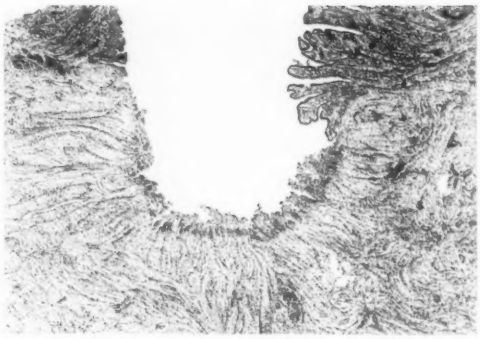

Fig. 14. (Case No. 27381.) Section through an ulcer showing the infiltration, destruction of the mucosa and the necrotic base.

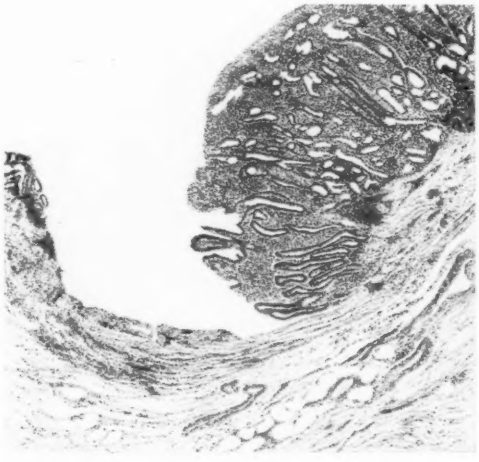

Fig. 13. (Case No. 25692.) Section through the border of the ulcer showing the overhanging hypertrophic border.

Fig. 15. (Case No. 30163.) Section through an ulcer with an extensively infiltrated base.

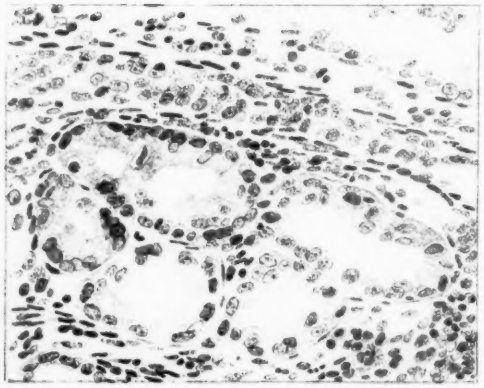

Fig. 16. (Case No. 30040.) Section showing the hyperplasia in the mucosa in an ulcer border.

In the overhanging border there is an extensive carcinomatous change with an hyperplasia of the glands and an infiltration with lymphocytes. The carcinomatous areas extend completely through the wall and the scar tissue of the perforation.

Case No. 21882 (Figs. 29, 30). Female, aged thirty-eight. Eight years ago she was weak, tired, and worn out; four to five years ago she became weaker. About one and one-half to two years ago she had her first sickening pain. There was no nausea, no vomiting, but occasional sour eructations. About two weeks ago there was a severe pain in the back and left costal arch. A tumor in epigastrium has been noticed for about seven or eight months; epigastric pain, gas, nervousness, weakness, and loss of flesh. Gastric analysis (second test) showed a total acidity of 50, free hydrochloric acid 30, combined hydrochloric acid 14. At operation two-thirds of the stomach were removed for carcinoma associated with ulcer. The specimen contains an ulcer from 3½ to 4 cm. in diameter and from 1½ cm. to 2 cm. in depth. There is a perforation of all the coats of the stomach, which has become adherent to neighboring organs. There is an extensive carcinomatous involvement of the ulcer base.

The specimen shows that the ulceration, although it might have started as a simple ulcer, has become deeper through the process of erosion of tissue composed of carcinoma. Such specimens have undoubtedly led to the belief that all ulcers which show carcinoma were developed in this manner. It is impossible to say whether or not this originally was an ulcer, or carcinoma with secondary ulceration.

Macroscopic description. Ulcers of the stomach vary in size from 1 mm. (Figs. 1, 2, 3) to several centimeters in diameter and from 1 mm. to 2–3 cm. (Fig. 30) in depth. They may be single or multiple (Fig 1). The base may be ragged or smooth. All of the ulcers in my series have rough bases because they were removed soon after an acute attack or in the stage in which mild inflammatory symptoms were present. The base contains elements of the mucosa, muscularis mucosæ, submucosa, or muscularis, depending upon the extent of the necrosis, as may be seen in Fig. 3, in which the smallest ulcer (Figs. 1, 2, 3) has eroded about half of the mucosa forming a base containing glands and infiltrated interglandular stroma. The largest ulcer in case No. 18088 (Fig. 2) involves the muscularis. On section through the specimen, the immediate base is seen always to be composed of connective tissue, which speaks perhaps for the gradual development of the ulcer instead of a rapid destruction below the muscularis mucosa. The initial erosion or necrosis of the mucosa may be of rapid formation, but the connective tissue base seems to show that the process is sufficently slow below the muscularis mucosæ for the formation of a temporary, if not permanent, barrier of scar tissue. Hæmorrhagic areas in the base are present in many ulcers in this series. The border of the mucosa which has the color of congested normal mucosa, does not always show evidence of hypertrophy, especially in small ulcers. In

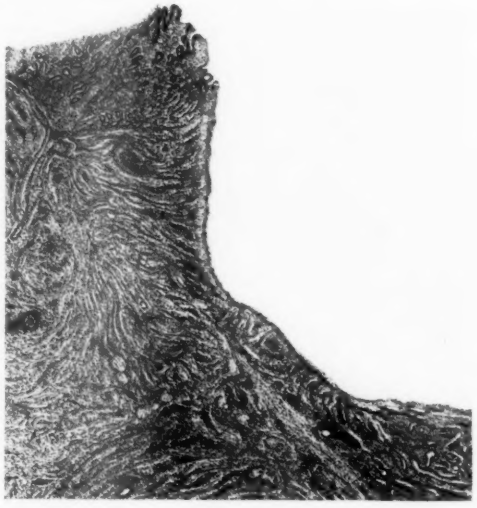

Fig. 17. (Case No. 27919.) Section through a portion of the border of a benign ulcer.

the larger ones, which appear to be of long standing, the border of the mucosa projects or hangs over the edge and is almost always hypertrophic. When one examines a fresh ulcer in gross section there are four distinct coats visible: the mucosa, submucosa, muscularis, and subserosa. These are either eroded in the base of the ulcer or infiltrated with scar tissue (Figs. 1, 2). It is difficult and often impossible to detect epithelial growths in the wall of early ulcers (Figs. 18, 20). In many of such cases which, grossly, one is justified in calling an ulcer, early microscopic carcinomatous invasions from the mucosa exist (Figs. 18, 20).

Microscopic description (low power). The mucosa of an ulcer border rests on or is marked off from the submucosa by the muscularis mucosa, which is composed of two or three rows of muscle cells. The glands which are regular in shape in the border of some ulcers may be seen cut longitudinally or transversely (Figs. 3, 4). The demarkation between the glands and the interglandular tissue is sharp. There is a regularity in the arrangement of the component parts of the mucosa, which is best seen with low power. An infiltration with leucocytes or lymphocytes, or both, destruction of the glands, and invasion of the submucosa, may be readily seen with this power. The base is composed of dense connective tissue, the general growth of which is perpendicular, or nearly so, to the base (Figs. 2, 11). The base which extends to the border of the mucosa is infiltrated and necrotic (Figs. 14, 15). If there are remnants of irregular glands and the muscularis mucosæ has been destroyed or penetrated by perverted epithelium, one may be sure that carcinoma is present (Figs. 26, 28). If the base does not show these elements a careful search should be made for epithelial structures in the rest of the submucosa (Fig. 21). If such be present they should be studied for any irregularity in architecture, as seen in Figs. 22, 23. If perfectly regular (Figs. 16, 24) one may be dealing with an adenoma. If irregular (Figs. 22, 23) one is surely dealing with carcinoma. In the mucosa the differentiation between infiltrated tissue, inflammatory hyperplastic tissue, adenoma, and carcinoma is not always possible with a low power. The submucosa and mus-

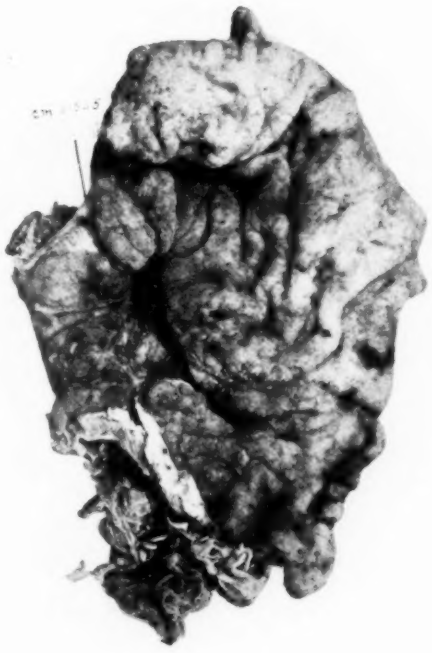

Fig 19. (Case No. 21555.) Single gastric ulcer with a carcinomatous border.

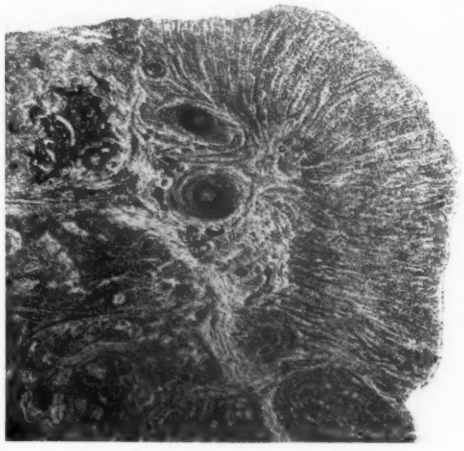

Fig. 18. (Case No. 27919.) Section through a portion of the border of a malignant ulcer, showing islands of carcinoma in the submucosa.

Fig. 20. (Case No. 21555.) Gross section through the ulcer.

cularis in ulcers and ulcers associated with carcinoma in the immediate vicinity of the lesion are infiltrated with scar tissue, and usually the lymph spaces are filled with lymphocytes (Fig. 15). Not infrequently aggregations of lymphocytes may be seen throughout the wall, especially in the mucosa and submucosa.

Microscopic description (high power). Groups of cells (Figs. 16, 22, 23) such as may be seen in a section through one gland should be studied with the high power to determine whether or not the border of an ulcer has passed beyond the stage of inflammatory hyperplasia. A study of the glands in this manner reveals the following conditions: In the smallest ulcer seen in Fig. 3, the bases of the cells rest regularly on a basement membrane and do not penetrate it. The relative proportion between the nucleus and the protoplasm is that of a differentiated cell and is about 1:3 or 1:4. The surrounding stroma is infiltrated with lymphocytes. The nuclei take the stain (Unna's polychrome methylene blue or hematoxylin) densely, and are either oval or round and vary in size and shape within the normal limits of normal gastric gland nuclei, depending on the plane in which they are cut. They are regular in shape and size. In the border of an ulcer which shows a more marked reaction to the irritant the same picture may be seen accompanied by more extensive hyperplasia (Fig. 16) and increase in the relative proportion of the size of the nucleus to protoplasm. The nuclei stain less densely. In this condition the line of demarkation between the stroma and the gland is usually not so regular. The glands may be and often are distended and distorted. In the same specimen in which such an hyperplasia occurs one may frequently see glands which are more irregular and possess all the characteristics of hyperplasia, with the addition that the nuclei are irregular in size and shape beyond the normal limits (Figs. 22, 23). Indeed some may be two or three times the size of the nuclei lying next to them. Such irregularity is seen

Fig. 21. (Case No. 21555.) Section through the hypertrophic border showing the ulcer characteristics and the invasion of the submucosa by hyperplastic epithelium of the border.

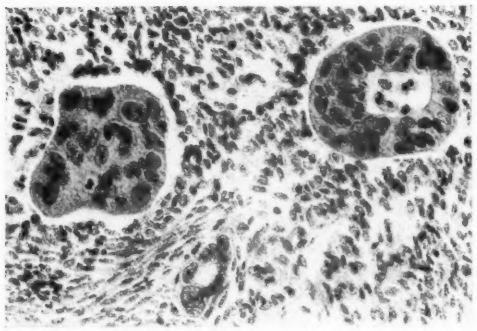

Fig. 22. (Case No. 21555.) Islands of carcinoma in the submucosa.

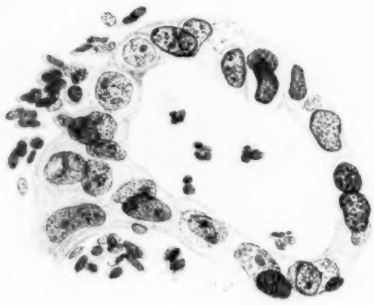

Fig. 23. (Case No. 21555.) Irregularly shaped epithelial cells in the border of the mucosa near the muscularis mucosæ.

in more extensive carcinomata and no hesitation occurs in making a diagnosis. Such a picture occurs in very early cases in the mucosa, before the submucosa has been invaded, and should be also considered carcinoma. One need not always wait for the basement membrane to be ruptured or invasion of tissue in which normally there is no epithelial tissue. There are many cases, however, in which the differentiation between hyperplasia and malignant hyperplasia is impossible at present on account of the apparent lack of demarkation between simple inflammatory hyperplasia and malignant hyperplasia. We are beginning to have it strongly impressed upon us that hyperplasia is a forerunner of malignancy, that hyperplasia varies in degree, and that carcinoma is a malignant hyperplasia which also varies in degree, and that some of the degrees, so far as the morphology is concerned, are indistinguishable, if not identical.

Ulcer and malignancy. The question, do ulcers become malignant as one of their sequelæ, seems, from my material at least, to be answered in the affirmative. What percentage heal, perforate, or become malignant is impossible to determine. The close association of carcinoma with ulcer may be strikingly seen in the fact that seventy-one per cent of all our resected specimens of the stomach for carcinoma were associated with definite ulcers (Wilson and MacCarty)[1] and that sixty-eight per cent of the resected ulcers of the stomach, including the duodenal ulcer, which rarely becomes malignant, were associated with carcinoma.

Ulcer process and life history of gastric ulcer. From a study of the morphology of ulcers it would seem that the process of ulceration, erosion, or necrosis manifests itself in single or multiple lesions, and that the initial lesion, at least in many cases, is a destruction of the mucosa itself, and that the reaction to this destruction is a connective tissue proliferation, and an attempt on the part of the epithelium of the mucosa to replace that which was lost (Fig. 5). The architecture of the connective

Fig. 24. (Case No. 21555.) Microphotograph of regularly shaped glands in the mucosa near the ulcer border.

[1] American Journal of the Medical Sciences, December, 1909.

Fig. 25. (Case No. 24527.) Gastric carcinoma.

tissue proliferation in the underlying tissue forming the base of all the ulcers studied in this series is such as to form an attempted barrier against further destruction. This barrier undergoes necrosis in the ulcer crater, thus increasing gradually the depth. If the base contains carcinomatous tissue, it too shares in the destruction (Figs. 26, 28). Perforation occurs by extension of the inflammatory process through the lymphatics, or by direct erosion, as may be seen in some acute cases. One may state the life history of gastric ulcer after the initial necrosis, the nature of which we do not know, as a gradual necrosis of the mucosa, muscularis mucosæ, submucosa, and subserosa. Ulcers heal, as may be seen at autopsy; they deepen and perforate as seen at autopsy and operation, or become malignant, as seen especially at operation. The last condition is often the sequel of ulcer, because we find ulcers which show no carcinoma, and ulcers which, grossly and microscopically, are exactly similar to the ulcers without carcinoma, but which contain small areas of irregular gland structures, with irregular nuclei, which show irregular mitosis. These islands of perverted epithelium may be seen in the dense scar tissue of the submucosa, just under and connected with the mucosa of the border (Fig. 21). Such ulcers do not present any epithelial elements in the base, and are therefore not ulcerated carcinomata.

CLINICAL DIAGNOSIS

The details of the clinical diagnosis will not be considered in this paper. While there has been a vague feeling from the pathological standpoint that carcinoma frequently occurs upon gastric ulcer, strong pathological evidence has been wanting. The clinician has for years noticed that carcinoma of the stomach often follows a prolonged history of gastric ulcer, and has believed that such was a forerunner of malignancy. The evidence, however, was only circumstantial. The fact established allows and demands a stronger admonition to the diagnostician who, as soon as he has diagnosed ulcer of the stomach, must consider the strong possibility of its becoming malignant. The chances of this occurrence may be readily seen, as stated above, in the fact that seventy-one per cent of our resected specimens of gastric carcinoma were associated with ulcer, and that sixty-eight per cent of our resected gastric ulcers were associated with carcinoma. It must be granted that gastric ulcers do sometimes heal with or without treatment, when seen early, or when not seen at all until autopsy, but unfortunately the early stage of ulcer cannot be so easily recognized,

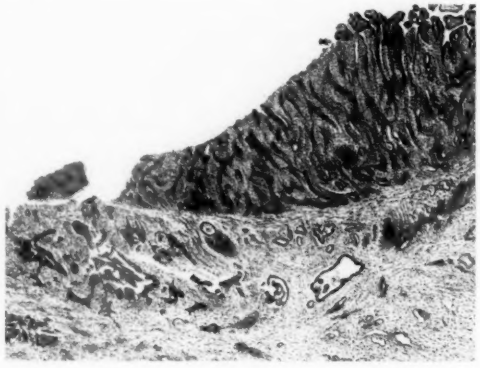

Fig. 26. (Case No. 24527.) Section through the border of the ulceration showing carcinoma in the border, submucosa, and the base.

and when recognized at the first definite sign or symptom it is impossible to determine whether the ulcer is a small one or a large one, or whether it has been present for weeks or months without having given rise to definite symptoms or even symptoms other than slight discomfort. Many cases with ulcers do not give a history of vomiting blood. As may be seen in cases 30163, 28173, 27381, 27919, 21882, 16651, 24527, many cases give a history of hyperacidity and do not show hyperacidity at the time of gastric analysis, and therefore absence of hyperacidity is of no value in a case which otherwise gives gastric symptoms. Lactic acid and fatty acids are not to be expected until there is mechanical or motor obstruction, which may occur associated with a small or a large ulcer, depending upon its location. The length of the history of epigastric discomfort or distress varies within wide limits, and the case with a short history often has a more extensive lesion than one with a long history. The lesion occurs most often, and practically always in early adult life or middle life. Our cases have occurred oftener in males than in females. A few, as may be seen in cases 18088 and 30163, give previous histories which appear

Fig. 27. (Case No. 16651.) Gastric carcinoma.

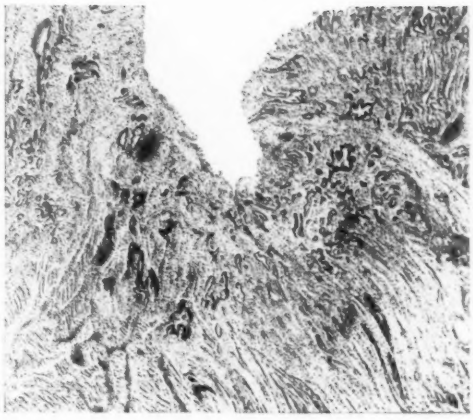

Fig. 28. (Case No. 16651.) Section through the border of an ulcer in which the mucosa, submucosa, and base are extensively infiltrated by carcinoma.

to be appendicitis. This coincident, if it be a coincident, is well worth considering however, as a possible etiological factor in view of some experimental and clinical experiences. Cannon has, by the injection of irritants into the large intestine, produced a retardation of the gastric discharge. Roger has shown that the injection of betanaphthol into the cæcum produces erosions of the mucosa. Litthauer has produced ulcers, which do not heal, by the production of localized anæmia and destruction of the mucosa. Clinically, many cases of appendicitis, especially chronic appendicitis, present symptoms of gastric disturbance which predominate those in the appendix region. Such cases, after the removal of the appendix are relieved and recover from the gastric symptoms. In these cases the stomach and duodenum present no lesion recognizable on exploration. These clinical and laboratory experiences are sufficiently striking to warrant further study and experimentation in regard to the possible production of pyloric spasm, gastric anæmia, hyperacidity, and necrosis or ulceration of the mucosa.

RESUME

1. Ulcers may be single or multiple and in different degrees of extension in the same specimen.

2. After the initial destruction of the mucosa,

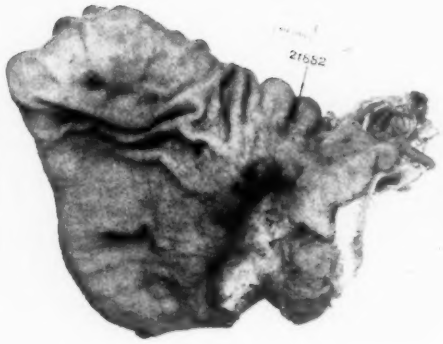

Fig. 29. (Case No. 21882.) Gastric carcinoma.

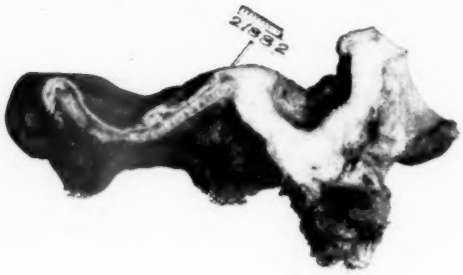

Fig. 30. (Case No. 21882.) Gross section showing the great depth produced by the process of erosion.

there is definite deepening of the ulcer by necrosis.

3. This deepening is sufficiently slow to allow a dense connective tissue barrier against perforation to be formed.

4. Ulcers heal, perforate, and become malignant.

5. Perversion of the glandular elements occurs in the mucosa, and the cells then invade submucosa.

6. One cannot say positively that all carcinomata of the stomach have developed on ulcer, because carcinomatous tissue in the base of an ulcer may be an ulcerated primary carcinoma.

7. The length of the clinical history is no positive index of the extent of the lesion.

8. The absence of blood in the vomitus or gastric contents at the time of laboratory analysis when associated with gastric symptoms is not evidence against the presence of ulcer.

9. Absence of hyperacidity at the time of gastric analysis is also no evidence against the presence of ulcer.

10. Clinically, with our present means of diagnosis, it is impossible to say that a gastric ulcer is not malignant.

11. The intimate relationship between irritation in the appendix or cæcum and gastric disturbance may have some bearing in the etiology of ulcer.

LITERATURE

BAILLIE. The Morbid Anatomy of Some of the Most Important Parts of the Human Body. London, 1793.

ABERCROMBIE. Edinburgh Med. and Surg. Journ., vol. xxi, 1824.

CRUVEILHIER. Anatomie pathologique du corps humain, tome i, 1829–1835; tome ii, 1835–1842.

MORGAGNI. (1761).

ROKITANSKY. Lehrbuch iii.

MÜLLER. Das corrosive Geschwür im Magen und Darmkanal, Erlangen, 1860.

HEITLER. Wien. Med. Wochenschrift, 1883.

WALDEYER. Virchow's Archiv., bd. 41.

HAUSER. Das chronische Magengeschwür, Leipzig, 1883.

WELCH. Pepper's System of Medicine, vol. ii., 1885.

WILSON. Journ. Amer. Med. Assoc., Dec. 2, 1905.

WILSON AND MACCARTY. Amer. Journ. of Med. Sciences, Dec., 1909.

HEDBLOM AND CANNON. Amer. Journ. of Med. Sciences, Oct., 1909.

ROGER. Archives de Medicine Experimentale, vol. xviii, 1906.

LITTHAUER. Virchow's Archiv., bd. 195, hf. 2.

MIXED TUMORS OF THE UTERINE BODY[1]

By ISABELLA C. HERB, M. D., Chicago, Illinois

IT has been the generally accepted plan among pathologists to give tumors with a complicated structure a combination of names corresponding to the predominating tissue found. When, for instance, a growth is composed of different tissues so that each helps to make the structure of the tumor, it is given the name of the principal tissue, as adeno-chondro-sarcoma, adeno-myo-sarcoma, rhabdo-myoma, etc. Although these descriptive names have a simplicity to recommend them, they are to be discouraged, as they lead to wrong and conflicting ideas regarding the true nature of the growth. Tumors which, according to their etiology, development, and structure, certainly belong to the same group are given altogether different names. If it were possible to make serial sections of an entire tumor and select a name which would indicate all the kinds of tissue found, it might be acceptable, but this is impossible. In the majority of instances only small portions are examined and it is presumed that the entire mass corresponds to those parts. For example, tumors of the testicle which appear under the names of chondro-adenoma, adeno-cysto-sarcoma, etc., and kidney tumors found in childhood, are called myo-sarcoma, adeno-sarcoma, rhabdo-myoma, etc., and the growths in the salivary gland in which various tissues are found are given a variety of names in literature. Birch-Hirschfeld believes that certain kidney tumors belong to the same great group and has called them "embryonal glandular sarcomas." On account of the grape-like appearance of similar growths occurring in the cervix, Pfannenstiel suggested the name "traubige sarcoma." Others, notably Wilms, in his masterly monograph on mixed tumors, includes all growths which develop from more than one of the germinal layers, under the term of "mixed tumors." This includes not only the simple mixed tumors but the complicated dermoid cysts of the ovary and testicle.

Fig. 1. *a*. Uterine wall. *b*. Tumor mass.

The genesis of these complicated tumors is still an interesting question. Bonnet believes that those occurring in the ovary are developed from the fertilized polar globules or from imperfectly differentiated blastomeres. Parthenogenesis has been suggested for the growths which occur in the testicle and ovary. Neither of these theories would account for the similar, but less complicated growths, which occur in other parts of the body. The two most common theories at present are metaplasia and Conheim's theory of misplaced embryonal tissue, the latter having the greater number of adherents. Wilms accepts this theory and believes that the complicated dermoid cysts and teratoid mixed tumors are developed from germinal tissue containing the three layers. He suggests that the displacement occurred during early fœtal life and that the varied structure is the result of irregular proliferation of the derivatives of the three layers. The various kinds of tissue do not reach the same

[1] From the Surgical Department, Rush Medical College.

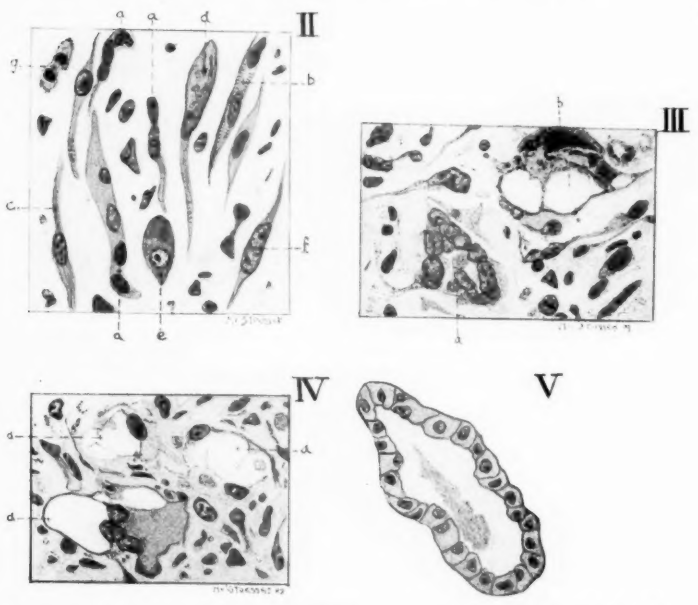

Fig. II. *a*. Elongated cells with multiple nuclei arranged in rows. *b*. Transversally striated cells. *c*. Longitudinally striated cell. *d*. Club-shaped cell with one end long drawn out. *e*. Cell with eccentrically placed nucleus and deeply staining eosin protoplasm. *f*. Spindle cell with vesicular nucleus. *g*. Mitotic figure.
Fig. III. *a*. Giant cell. *b*. Mass of chromatin and two vacuolated cells.
Fig. IV. *a*. Large vacuolated cells.
Fig. V. Cyst lined with cuboidal cells.

degree of differentiation, or the simpler forms may be composed of derivatives of two germinal layers. Experimentally transplanted embryonal tissue into animals of the same species has not been followed by tumor formation; however, this hypothesis seems best to fulfill all the requirements. It is difficult, nevertheless, to conceive how tissue can lie dormant in certain organs until middle life or past, although growths containing the same kinds of tissue in other organs always develop in early childhood. For example, whereas the most common kidney tumor of adult life is the hypernephroma, the most common in childhood is the mixed tumor; a large per cent of which develop during the first three years of life. Paul found this variety of growth in both kidneys of a seven month fœtus. The oldest patient found in literature was eleven years. (Perthes.)

This holds true of the growths occurring in the vagina. The age of the patients varies from one to three years. The oldest reported case was by Frau Kaschewarowa in a fifteen year old girl. Mixed tumors of the cervix occur after puberty; however, Pick reports a growth in a two year old, and Smith one in a four year old child, which they considered originated in the cervix, the vagina becoming secondarily involved. Those occurring in the uterine body were all in a women past the menopause and who had borne children. The congenital nature of the latter consequently are harder to explain.

Another question which confronts us is the much greater malignancy of the mixed tumors of the kidney, testicle, vagina, and uterus than those occurring in other regions. Mixed tumors of the salivary glands only exceptionally recur. The same is true of ovarian dermoids, which, according to some authorities, form 9 per cent of all ovarian tumors. Mixed tumors of the testicle and kidney usually recur within two years after removal, whereas those of the

uterus and vagina frequently recur within a few months, in marked contrast to the parotid growths which may be present for twenty to forty years. As a rule they recur locally and rarely form metastases; when they do the new growth frequently is composed of a single kind of tissue, usually the sarcomatous element. Eberth reports striated muscle in the metastases from a kidney tumor, and Wagner found tissue corresponding to the original cervical growth in a lung metastases. Metastases occur through the blood stream, the neighboring lymph glands usually remaining uninvolved. Tumor cells may penetrate the vessel wall and cause thrombosis.

These tumors when originating in the cervix scarcely ever involve the uterine body, but extend into the vagina and vaginal wall; on the other hand, those occurring in the uterine body rarely involve the cervix, but extend into the uterine cavity as a polypoid mass and penetrate, to a greater or less extent, the uterine muscle.

Inasmuch as mixed tumors of the uterine body are of rather infrequent occurrence, it was thought the following was worthy of report:

Mrs. C., 55 years of age, widow, mother of three children, had two premature births, cause unknown, has always enjoyed good health. Menstruation, which had been regular and painless suddenly ceased thirteen years ago. Present illness began eight months ago with pelvic discomfort. At present there is a profuse, watery vaginal discharge, which at times becomes quite hæmorrhagic. The patient is much emaciated and very weak. Pelvic examination reveals an enlarged uterus and considerable general pelvic tenderness. A small piece of tissue was removed by curette from the uterine cavity. A diagnosis of malignancy was made, but whether sarcoma, carcinoma, or both, could not be positively stated. The following day a supravaginal hysterectomy was made. Recovery was uneventful, the patient returning to her home in about three weeks. Regional recurrence, with death in six months after the operation.

Gross description (see Fig. 1). The specimen consists of the body of the uterus with intact right ovary and tube. The ovary is atrophied. The tube is patulous, somewhat enlarged and covered on its superior aspect by fibrous tags. The uterus, which has been amputated at the cervix, is enlarged, globular in form, and measures 10 cm. in length, 7.5 cm. in breadth, and 6.5 cm. in its anteroposterior diameter. The external surface is smooth, except at the top of the fundus where many fibrous tags are present, due to omental adhesions. Internally, extending from the fundus and region of the right tube, is a mass of rather firm consistency which fills the entire uterine cavity (Fig. 1, *b*). The surface of the growth is composed of polypoid excrescences measuring from 0.5 to 3.5 cm. in length, the tips of many appearing dark and necrotic, which no doubt accounts for the hæmorrhage. The remainder of the growth, which extends entirely through the uterine wall, is well preserved. The mucosa below its attachment is slightly thickened but otherwise appears normal.

Microscopical examination. Sections were taken directly through the growth and at various points throughout the mass, also from the uterine wall between the tumor pedicle and amputation stump. They were fixed in Orth's fluid and alcohol, embedded in paraffin and celloidin and stained by various methods. The growth which is very cellular is composed of elongated cylindrical cells, which occasionally form small bands or have more or less of a parallel arrangement. Many of these cells are unstriated, others show a transverse or longitudinal striation. The longitudinal striation extends as a rule throughout the cell (Fig. 2, *c*), while the transverse appear in only a part, frequently only showing at its borders (Fig. 2, *b*). The nucleus may be single or multiple and situated in the center of the cell or at one end in which case the end is club-shaped with the other end long drawn out (Fig. 2, *d*). The protoplasm is frequently vacuolated (Fig. 4, *a*). Elongated cells with multiple nuclei arranged in rows are occasionally encountered (Fig. 2, *a*). These cells are looked upon by some writers as due either to degeneration or indicate malignancy (Hunziker), but according to Weismann's theory (Minot Human Embryology) such an arrangement of nuclei probably marks the center of proliferation. Cells in the various phases of mitosis are rather frequently seen (Fig. 2, *g*). All transitional forms are found, from the long drawn out spindle cell to band formations. As a rule no sarcolema could be demonstrated except occasionally in the vicinity of the nucleus. Between the cylindrical cells are large giant cells (Fig. 3, *a*), round or polygonal cells with a vesicular nucleus, cells with eccentrically placed nucleus and deeply staining eosin protoplasm (Fig. 2, *e*). Irregular masses of chromatin occur throughout the growth (Fig. 2, *b*). Marchand calls attention to the glycogen content of these tumors. Unfortunately the fresh tissue was not examined for this substance, but as it is readily dissolved out, it is probable that the vacuoles referred to above are due to the loss of glycogen. No retrogressive metamorphosis is present, except on the surface of the excrescence in the uterine cavity, where some nuclear fragmentation and slight necrosis is found. Thin-walled cysts (Fig. 5) lined by a single layer of cuboidal cells are occasionally found. The growth is very vascular, the vessel walls being composed only of an endothelial coat. The nature of the reticulum is not clear. Sections from the uterine wall below the growth contain no tumor tissue.

According to the usual nomenclature this growth would naturally be placed with the

rhabdo-myo-sarcomas, but for reasons previously stated we prefer the simple name of mixed tumor.

Mixed tumors of the uterine body, contrary to those of the cervix, are of infrequent occurrence. We found only eight authentic reported cases, including the one herein mentioned. The youngest patient was 40 years of age (Franqué). Menstruation had been irregular for four years. All the other women were past the menopause, their ages varying from 50 to 62 years. The clinical symptoms, without exception, were pelvic pain accompanied by a watery or bloody vaginal discharge which was fetid in some of the cases. The symptoms were of short duration, being from one to six months. A positive and correct diagnosis from currettage was not made. All the women had borne children. Franqué's patient had given birth to eleven, Penkert's to ten, Gebhard's had only three, but there had been eight or nine abortions; Hunziker's had two children, which was the smallest number reported. All the tumors sprang from the tubal region, except two, which developed in the posterior uterine wall. They were all single tumors, except Hunziker's, in which there was a hazelnut-size subperitoneal growth which he considered a metastasis. In Penkert's case the tumor, which was 7.7 cm. long and 6.5 cm. wide, sprang from a pedicle scarcely 1 cm. in diameter. In our case the tumor mass extended entirely through the uterine wall, however, it could readily be differentiated from the surrounding musculature. They usually fill the uterine cavity and present an irregular polypoid surface, with dark necrotic areas. They are of rather soft consistency and a grayish or yellowish white color. Microscopically besides sarcomatous tissue and the different forms of connective tissue, smooth and striated muscle, small cysts, cartilage, and tissue resembling carcinoma may be present. Metastases to other organs or involvement of regional lymph glands were not observed. One patient died of exhaustion seven days after total extirpation (Franqué). All of the remainder whose histories were followed after operation died from local recurrence within six months except Läwen's patient, who lived one year.

LITERATURE

AHLEFELD. Arch. für Heilkunde, 1867, viii, 560. Derselbe Arch. für Gyn., 1876, xvi, 135.
ANDERSON AND EDMONDSON. Nord. med. Arch. bd. 1, No. 4. Referat in Virch Hersch Jahresbericht, 1870, i, 187.
ASHFELD. Wagner's Arch. f. Heilkunde, 1867, viii, 560.
BILLROTH. Chirurg. Klinik, Wein, 1871–1876, 360.
BORST. Die Lehre von den Geschevulston, 1902, ii, 992, 200.
BIRCH-HIRSCHFELD. Beiträge z. path. Anat. u. Allgem. Path., 1898, xxiv, 343.
BONNET. Gaz. d. Hop. Par., 1888, lxi, 637.
DEMME. Neunzeherter Bericht über die Thatikeit des Kinderspitals in Bern, 1889, 95.
EBERTH. Virch. Arch., 1872, lv, 518.
FRICK. Virch. Arch., 1889, cxvii, 248.
GEISSLER. Inaug. Diss., Breslau, 1892
GANGHOFNER. Cit. nach Konig. Allgem. Chirurg., iii, 867.
GUERSANT. Jour. f. Kinderkrankheiten, 1881, xiv, 148.
GUSSEROW. Arch. f. Gyn., 1871, i, 240.
GIRODE. La Samaine medic., 1892, xii, 48.
HAUSER. Virch Arch., 1882, lxxxviii, 165.
HEGAR. Arch. f. Gyn., 1871, ii, 45.
HAHLDEN. Zieg. Beitr. zur path. Anat., 1893, xiv, 174.
KAHLDEN. Zeig. Beitr. zur path. Anat., 1893, xiv, 174.
KASCHEWAROWA-RUDNEWA. Virch. Arch., 1872, liv, 65.
KEHRER. Monatsschr. f. Geb. u. Gyn., 1906, xxiii, 646.
KELLER. Zeit. f. Geb. u. Gyn., 1890, xx, 116.
KOLISCO. Weiner Klinik. Woch., 1889, ii, 109, 159, 182.
KÖRNER. Inaug. Diss., Gottingen, 1892.
KEITLER. Monatsschr. f. Geb. u. Gyn., 1903, xviii, 231.
KLEINSCHMIDT. Arch. f. Gyn., 1891, xxxix, 1.
KUNITZ. Inaug. Diss., Berlin, 1885.
KUNERT. Arch. f. Gyn., 1874, vi, 115.
MUNDI. Am. J. Obs., 1889, xxii, 282.
MARTIN. Zeit f. Geb. u. Gyn., 1878, iii, 406.
MARSH. Path. Trans., London, 1874, xxv, 178.
MARCHAND. Virch. Arch., 1878, lxxiii, 289.
MARCHAND. Virch. Arch., 1885, c, 42.
MÖCKEBURG. Virch. Arch., 1907, clxxxvii, 471.
NIEBERGALL. Arch. f. Gyn., 1896, l, 129.
NIHRKORN. Virch. Arch., 1898, cli, 52.
PAUL. Trans. Path. Soc., London, 1886, xxxvii, 292.
PFANNENSTIEL. Virch. Arch., 1892, cxxvii, 305.
PICK. Arch. f. Gyn., 1894, xlvi, 191.
PERNICE. Virch. Arch., 1888, cxiii, 46.
PERTHES. Zeitschr. f. Chirurgie, 1896, xlii, 201.
REIN. Arch. f. Gyn., 1880, xv, 187.
ROSENSTEIN. Virch Arch., 1883, xcii, 191.
SANGER. Arch. f. Gyn., 1880, xv, 58.
SCHUSTER. Wiener Klin. Woch., 1888, i, 365.
SCHUCHARDT. Verhandl. der deutsch Gessel. f. Gyn., Leipzig, 1888, ii, 237.
SOLTENARM. Yahrbuch für Kinderheilkunde, 1882, xvi, 418.
SCHRÖDER. Hofmeyer Hand. der Krankheiten d. wieb. Geschlectorgane, 1889, 341.
SMITH. Am. J. Obs., 1883, xvi, 555.
SPIEGELBERG. Arch. f. Gyn., 1879, xiv, 178.
SPIEGELBERG. Arch. f. Gyn., 1880, xv, 437.
STEINTHAL. Virch. Arch., 1888, iii, 449.
THIEDE. Zeit. f. Geb. u. Gyn., 1877, i, 460.
THOMAS. Tract, Treatise Diseases of Women, 5th ed., 1880, 559.
VOGLER. Bruns Beitr. z. Klin. Chir., 1898, xxi, 173.
WEBER. Virch. Arch., 1867, xxxix, 216.
WEISMANN. Minot Human Embryology, 1897, 1475.
WINKEL. Lehrbuch der Frauenkrankheiten, Leipzig, 1886, 430.

WILLIAMS. Zeit. f. Heilk., 1894, xv, 141.
WILMS. Die Mischgeschweilste, Leipzig, 1899, 1900, 1902.
WINKLER. Arch. f. Gyn., 1883, xxi, 309.
(The following references deal particularly with the subject of this paper.)
BYSTROUMOFF-ECHERT RUDEUWA. Journal 1874; 442, cit. nach Kolesserikow. Virch. Arch., 1876, lxviii, 554.
COLOMIATTI. Arch. pur la scienze med., 1882, ii, 1.
FRANQUÉ. Zeitschrift f. Geb. und Gyn., 1899, xl, 183.
GEBHARD. Zeitschrift f. Geb. und Gyn., 1903, xlviii, 3.
HUNZIKER. Beitr. z. Geb. und Gyn., Leipzig, 1907, xii, 316, 2 pl.
LÄWEN. Zeig. Beitr., 1905, xxxviii, 177.
PENKERT. Hegar's Beitr. z. Geb. und Gyn., 1905, ix, 488.

THE NUTRITIONAL CHANGES OCCURRING IN FIBROMYOMA OF THE UTERUS INCIDENT TO PREGNANCY AND THE PUERPERIUM[1]

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BEFORE taking up for consideration the effect of pregnancy upon the nutritional changes of fibromyoma of the uterus, it is desirable to study briefly the life history of these neoplasms under ordinary or non-pregnant conditions.

Little is known regarding the etiology of fibromyoma of the uterus except that the growth of the neoplasm is associated with sexual maturity. The monthly engorgement of the uterine vascular system favors development, while the cessation of the menstrual function encourages degenerative changes. Fibromyoma rarely develops before puberty or after the menopause. Not only does the tumor cause sterility, but sterility favors the development of the neoplasm. After careful investigation of the subject, Kelly and Cullen (1) express the opinion "that the uterus must have something to do, and that if it is not kept relatively busy as a result of frequent pregnancies, it may tend to show its activity in another direction, namely in the formation of myomata."

The point of origin as well as the origin itself, of fibromyoma is a subject of dispute. Virchow (2) locates it in the smooth muscle tissue of the uterine wall. Others place the beginning of the growth in the blood-vessels of the uterus — the tortuous arterioles. Arteries supplying the growth usually show hyperplasia of the middle coat, often in a state of waxy degeneration.

Obliteration of the arteries is of common occurrence and lends strength to the theory that the main cause of the development of the neoplasm is endarteritis obliterans. Fibromyomata are composed essentially of the same structures as the uterus itself, viz.: muscular bundles and fibrous tissue.

The bundles of muscular fibres are formed into spherical lobes joined by connective tissue. This interlobular connective tissue forms a framework which binds the different lobes together and envelops the growth as a whole with a capsule of variable thickness. This capsule may be tightly adherent to the subjacent tumor or it may have a loose attachment. The lymphatic and blood currents circulate within the capsule and in the interlobular connective tissue. The vessels of the capsule proper give off secondary branches, these anastomose with other vessels and form interlobular networks — some branches penetrating the lobes. The center of each lobe receives a small blood supply compared with that of the peripheral portions of the neoplasm. As a rule, fibromyomata are not well vascularized.

The rapidity of the growth and the size of fibromyomata vary within wide limits. Tumors may cease to grow; may remain stationary; may decrease in size or disappear; may be cast off from the uterine attachment, or may undergo degenerative changes. Starting

[1] Mütter lecture. Read at College of Physicians and Surgeons, Philadelphia, December 10, 1909.

as interstitial tumors they may produce uniform enlargement of the uterus; or working to one or other surfaces they may become submucous or subperitoneal. The base of the attachment may become reduced to a small pedicle containing the nutrient artery. A case is mentioned by Kelly (3), which demonstrates the peculiar behavior of these tumors. In 1869, Dr. Washington Atlee examined a patient and made a diagram of a large interstitial fibroid. The uterus was then the size of a seven months' pregnancy, uniformly enlarged, and the uterine sound entered the cavity eight or nine inches. Twenty-five years later, Dr. Kelly operated and removed a fibroid weighing fifty-nine pounds attached by a narrow pedicle to a small uterus which had been crowded to the pelvic floor.

About two-thirds of all fibromyomata show non-malignant degenerative changes after the occurrence of the menopause. The frequent coexistence of fibrous changes with hyaline degeneration is attributable to faulty nutrition. Areas of hyaline degeneration sometimes liquefy and break down. If such liquefaction be extensive and accompanied by fusion of different foci, a large cyst will be formed with irregularly shaped wall. Again, hyaline degeneration may undergo fatty changes with extensive central necrosis.

Œdematous and cystic degenerations are considered the result of interference of the return circulation. Parts of the tumor or the whole tumor become soft and fluctuant owing to serous fluid imprisoned within enormously dilated lymph channels. The ultimate result may be the formation of a thin walled cyst traversed by fibrous bands which are the remains of obliterated blood-vessels. Œdema is frequently the forerunner of gai grene.

Myxomatous degeneration is allied to œdematous and is characterized by the effusion of mucous material between the muscular bundles and proliferation of round cells in the connective tissue.

Tumors devitalized on account of deficient blood supply, and which have already become the seat of some form of degeneration, are prone to undergo calcareous changes. The calcareous infiltration may begin in the center or in the periphery of the growth. Calcification is regarded as a conservative process by means of which a degenerated mass is converted into an innocuous body.

Necrotic changes are among the most frequent and dangerous complications of fibromyoma. Efforts at separation and expulsion of submucous growths are liable to be followed by sloughing of .the tumor. A neoplasm undergoing necrotic changes may be infected by putrefactive germs. Micro-organisms may reach subperitoneal tumors by way of the intestinal tract. Diminished vitality of the tissues due to pressure or to adhesions of the bowel to the tumor favors the penetration of bacteria. The appendix may become adherent and produce suppuration or gangrene of the tumor. Interstitial tumors may be infected from the bowel or from the uterine mucosa. Infection by means of the circulation is brought about through the agency of septic emboli.

Pain is a marked symptom of the occurrence in some form of degeneration of the fibromyoma, having been met with, according to Noble (4) in two-thirds of the necrotic, three-fifths of the cystic, and one-third of the myxomatous degenerations.

This brief sketch of the life history of fibromyoma of the uterus is introduced to lead up to the consideration of another phase of the subject. It would seem *a priori*, that every line of investigation had been thoroughly studied. The etiology of the neoplasm; its frequency; its growth and degeneration; the anatomic varieties and pathology; complications; symptoms; diagnosis; prognosis; treatment, medical and surgical, have all been subjected to exhaustive research.

The pendulum of thought swung from the gynecologic to the obstetric viewpoint and led to investigations regarding the influence of fibromyoma of the uterus upon sterility and the various complications incident to pregnancy and labor. Abortion and premature labor; malpresentation of the infant; placenta prævia; and post-partum hæmorrhages, are some of the recognized complications. Dystocia, often demanding artificial and surgical methods of delivery, has received careful consideration. When to operate, how to operate, having in mind the interests of two lives, have been

questions of vital importance to gynecologic and obstetric surgeons.

It would seem indeed that every pertinent line of thought had been so thoroughly worked over that it was worn threadbare; yet one field of investigation has received but scant cultivation, and to that I direct your attention to-night. Withdraw consideration of the effect of the tumor upon pregnancy, labor, and the puerperium, and reverse the lever of thought to take up the study of the effect of pregnancy and the puerperium upon the tumor. This will lead to the recognition not only of nutritional changes in the fibromyoma, both physiologic and pathologic — dependent upon changes in the maternal organism as a result of pregnancy, but also to the occurrence of gangrene and suppuration — the dangers of which are greatly enhanced by the complication of pregnancy. The developmental and retrogressive changes of pregnancy and the puerperium respectively exert a marked influence upon the growth and decay of tumor life.

The subject will be presented from the standpoint of physiologic and pathologic study. The physiologic study includes changes observed in both the normal uterine structure and in the complicating fibromyoma.

PHYSIOLOGIC CHANGES IN THE NORMAL STRUCTURE OF THE PREGNANT UTERUS

The first appreciable alteration observed in the structure of the normal uterus as a result of impregnation is increased vascularity accompanied by increased growth. The progressive enlargement of the organ during the first half of gestation is due to hypertrophy and hyperplasia of the smooth muscular element. During the second half, distension of the uterus is an additional factor in promoting enlargement. The connective tissue between the muscular fibres is not only augmented by proliferation but is also thickened by serous infiltration. White cells in great numbers escape from the engorged blood-vessels and a nutritive energy is awakened which borders upon inflammatory action (5). The final result of this developmental activity is to build up tissue and increase the size of the organ enormously. The length of the virgin uterus is about 7 cm.; that of the full term gravid organ about 35 cm. The weight of the former is 43 grams; that of the latter about 1,000 grams. Equally striking as the constructive phenomena of pregnancy is the destructive of the puerperium. In five or six weeks after the expulsion of the full term product of gestation, retrograde changes affect the reduction of the uterus to almost its original size and weight. Nearly 1,000 grams of highly vitalized tissue is devitalized and eliminated. This process of involution consists of degenerative changes — granular and fatty — of the uterine structure. The albumen of the muscle cell is to a great extent converted into peptone and discharged with the urine. In addition to the process of involution permanent contraction and diminished blood supply act as factors in reducing the size of the uterus.

PHYSIOLOGIC CHANGES IN FIBROMYOMA COMPLICATING PREGNANCY

It has been for a long time and still is, a matter of common observation that pregnancy inaugurates certain changes in fibromyoma of the uterus. The tumor increases in size; it changes position; it undergoes alterations of shape and consistency during pregnancy, while it diminishes rapidly in volume and may disappear during the puerperium. Being composed of the same histologic elements as the normal uterine structure it participates in the same physiologic changes that occur in that organ during gestation — nutritional growth of the muscular and connective tissue elements with serous infiltration of the latter. The muscular fibres are hypertrophied, multiply themselves, and the process does not go on without a certain degree of inflammation which is accompanied by an aggregation of white cells in the intermuscular spaces.(5) Although the uterine structures proper of the gravid uterus are engorged with blood a complicating fibromyoma receives an insufficient blood supply. The nutrient vessels do not enlarge, as a rule, to any appreciable extent; they are surrounded by thick fibrous walls and are deprived of the elastic coat. The hyperplastic middle coat is frequently found in a state of waxy degeneration. Changes in the arteries may exist to the extent of obliter-

ation. The primary capsular network of blood-vessels exhibits increased vascularity while the deeper lobes of the tumor will be found deprived of blood to the degree of exsanguination. The result is degeneration of a large number of muscular bundles and the absence of red globules in some of the arterioles.

The increase in volume of the neoplasm during pregnancy is not so much due to hypertrophy and hyperplasia of the muscular fibres as to rapid proliferation of the fibrous element and especially to serous infiltration or œdema. Gusserow first demonstrated that a true growth of the tumor is relatively rare and that the occasional enormously large increase in size is due to the increased amount of fluids in the tissue. Owing to this increased fluidity the consistency of the tumor will naturally decrease and we find those growths which take on a rapid increase of volume are soft and apparently fluctuating. This softening is nearly always due to serous infiltration of the connective tissue and rarely to myxomatous or cystic degenerations (6).

The actual increase of the muscular element is witnessed principally in the interstitial type of fibromyoma except, as pointed out by Arnheim (7), in those interstitial growths which are encapsulated by a firm, rigid, and poorly vascularized capsule. The more intimate the union of the growth, with the uterus, the more it will partake of these physiologic processes, and the closer the structure of the tumor approaches to that of the organ the more pronounced will be the changes.

The influence exerted by the physiologic changes of pregnancy is observed not only in the increased growth of the tumor and its softer consistency, but also in the alteration of its shape. The general tendency of the neoplasm is to adapt itself to the growth of the uterus and to become flattened and elongated. Olshausen(8) has recently called attention to the flattening of the tumor during pregnancy. A tumor that had presented all the appearances of a globular growth will apparently disappear by pressure of the increased volume of the uterus forcing the neoplasm to assume a flattened shape difficult to recognize. After birth the tumor quickly resumes its original shape.

This beneficent alteration of the form and position of the tumor is demonstrated most strikingly and most happily in those growths situated within the true pelvis. Tumors which had blocked the true pelvis during the early months of gestation and which had threatened to become incarcerated below the promontory of the pelvis, and which apparently had presented an insurmountable obstacle to delivery *per vias naturales* have softened, flattened, and elongated. The rising of the gravid uterus into the abdominal cavity aided by the changes of shape and consistency of the neoplasm; by the intermittent painless contraction of the uterus, and later by true labor pains, carries with it the growth which is eventually lifted above the superior strait. Lusk (9) and Jewett (10), in their respective text-books of obstetrics, describe a physiologic rearrangement of the muscular fibres during pregnancy and labor by which they are drawn up from the lower passive segment of the uterus to the upper active portion. If this be correct the change will assist materially in the elevation of the tumor.

Involution of the fibromyoma takes place during the puerperium as well as involution of the uterus. Enormous growth during pregnancy is followed by equally striking decrease in size of the neoplasm. The shape changes again to assume that which existed before the advent of gestational growth; the location of the tumor alters to its original position; the structure hardens. The hardening is the combined result of absorption of the serous infiltration of the tumor; the contraction of the organ, and the diminished vascularity. Exaggerated degrees of such changes may lead to absolute disappearance of the growth.

PATHOLOGIC CHANGES IN FIBROMYOMA COMPLICATING PREGNANCY

In the brief reference already made to the life history of fibromyoma of the uterus it is recognized that in conditions outside of the influence of pregnancy, the neoplasm is subject to various pathologic changes, and frequent as are those changes ordinarily the occurrence of pregnancy in a fibromyomatous uterus imparts extra liabilities, Nutritional effects leading up to necrosis and suppuration have

been recognized by pathologists and surgeons, but little consideration has been bestowed upon the subject from the standpoint of the coexistence of pregnancy. It is only in recent literature that one can find mention of it as an obstetric complication. Particularly worthy of notice is the inaugural thesis of M. George Berger, published at Paris in 1907. He has collected the reports of twenty-three cases of suppuration of fibromyomata in pregnant or puerperal uteri and made them the basis of careful study.

During pregnancy the poor vascularization of the neoplasm is further impaired by arteriosclerosis, waxy degeneration, and thrombosis of the blood-vessels. Marked exsanguination may terminate in gangrene, while œdematous and cystic changes may result from interference with the return circulation. Red degeneration of fibromyoma has been met with under other conditions but the best examples are observed in tumors associated with pregnancy. Bland-Sutton (11) has witnessed during the course of gestation the complicating fibromyoma assume a deep red or mahogany tint. In the early stages the color is observed in streaks, but as gestation advances the alteration of color permeates the whole tumor. Occasionally, even in the mid-period of pregnancy, this necrotic change may be so extreme that the central part of the neoplasm is reduced to a red pulp. The red color is not caused by increase of the muscular elements of the fibromyoma but to blood pigment diffused through the necrotic tissues of the tumor. Pain and tenderness are marked clinical features of red degeneration of fibromyoma complicating pregnancy. Complications arising during the course of pregnancy associated with fibromyoma of the uterus may be accidental as well as nutritional. They may originate from mechanical causes as when incarceration of the growth within the true pelvis is followed by pressure effect and necrosis of the tumor or of the surrounding soft parts.

Torsion of the pedicle may produce hæmorrhage within the fibromyoma leading to the formation of cystic spaces. Fatty degeneration, suppuration, and softening, with central necrosis and sudden disturbance of nutrition follows. Accompanying these changes will be stasis of the lymphatic circulation with dilatation of the lymph channels. Gradual mechanical atrophy of the tissues combined with diminished nutrition frequently leads to fatty degeneration (5). Torsion of the pedicle of a fibromyoma may also cause intraperitoneal hæmorrhage and collapse. Acute abdominal pains added to the clinical picture would simulate closely the symptoms of ruptured ectopic gestation (12). Increased vascularity of the surface of a subperitoneal fibromyoma may lead to a rupture of a superficial vein and fatal intraperitoneal hæmorrhage (13).

Schenk(14)removed a fibromyoma at the fifth month of uterogestation on account of severe symptoms, and found the growth degenerated in various parts. In his opinion the rapid growth of the neoplasm during pregnancy had caused a stretching of the capsule and diminished blood supply to the tumor.

J. D. Malcolm (15) removed a fibroid uterus seven weeks after premature labor and found a grayish white slough within the central portion. The condition he said was unique. It did not seem to be the ordinary sloughing due to infection from the uterine mucosa. The growth was so close to the uterine cavity that contamination from that source would inevitably have induced an ordinary putrid slough of the whole tumor and death of the patient, as the neoplasm extended as near to the peritoneum as to the mucous surface. The large number of muscle cells and greater contractility of the outer portion of the growth suggested that the central part had been subjected to considerable pressure, and that this, together with the diminution of the vascular supply caused by the involution of the uterus, afforded the most satisfactory explanation of the sloughing of the central part of the growth. According to this view the slough was aseptic and it is possible the dead tissue might have been slowly absorbed.

Nussbaum (16) claims that the irritation of fibromyomata causes inflammatory processes of the decidua and placenta which is manifested by increased secretion. A true hydrorrhœa gravidarum may result. Proliferation of chorionic villi with small warty or polyp-like excrescences produces intimate adhesions of the placenta with submucous fibromyomata.

He has experienced great difficulty in removal of the placenta and this is one of the chief causes of adherent placenta and retention of debris with attendant hæmorrhage after childbirth. He points out that putrefaction of these growths is especially liable to take place when manual detachment of the placenta is necessary, even under strict aseptic precautions.

Central hæmorrhage may result from torsion of the tumor or of the pedicle and from physiologic flattening and change of shape of the neoplasm. But undoubtedly the most common cause of hæmorrhage within the fibromyoma is uterine contraction. Gusserow doubts whether extravasations of blood take place before birth. Schültz (17) reported a case of total necrosis of an intramural fibromyoma caused by rupture of the nutrient blood-vessels during contractions of the uterus in the course of a miscarriage. Krugenberg (18) met with a case of sloughing and suppuration of an interstitial fibromyoma at the fourth month of gestation attributable to hæmorrhage between the neoplasm and its capsule brought on by the act of defecation.

Suppuration of fibromyoma may occur in the central or deeper lobules of the tumor or in the periphery directly beneath the capsule.

1. *Beginning in the center of the tumor.* The diminished blood supply and low degree of vitality of the deeper lobes are so marked that nothing but the existence of an aseptic field prevents suppuration. If the tissue be invaded by pathogenic microbes an excellent culture medium exists without phagocytic protection. The tissues break down into circumscribed purulent collections the pus appearing in the middle of necrotic cavities. The walls of the pus collections are formed by tissues possessing greater power of resistance. The limit of the dead and living structure is marked by an inflammatory zone with numerous phagocytes. Deep seated suppuration may involve any part of the tumor or one or more of its lobes. In some cases the suppuration is not circumscribed.

2. *Suppuration under the capsule.* The periphery of the fibromyoma, that portion in contact with the capsule, receives a more liberal blood supply and is therefore composed of vigorous tissue capable of offering resistance to pathogenic germs. The capsule itself being composed of dense fibrous tissue also combats the action of pus producing organisms. Suppuration of the loose cellular tissue separating the fibromyoma from the capsule tends to the formation of a liquid around the tumor in which it is bathed and which isolates the growth from the surrounding substance. The pus may be confined within the tumor, giving rise to augmentation in size of the growth and of the uterus; it may escape by rupture of the cyst wall into the peritoneal cavity, or it may discharge into the uterus and escape per vaginum.

Olshausen (7) reported a case in which the capsule of the tumor suppurated, broke through the broad ligament and later, under the influence of labor pains, ruptured into the abdominal cavity causing fatal peritonitis.

Adhesion of the tumor to the abdominal wall may permit escape of the abscess contents externally. Neugebauer (19) reported a case in which three months after the birth of the fifth infant a fibromyoma suppurated and opened spontaneously upon the surface below the umbilicus. By discharge and curettage through the artificial opening about twenty-five ounces of debris were removed during a period of six months. Suppuration ceased and the wound healed.

Suppuration follows abortion, miscarriage, premature and full term labor. On the other hand, the process may excite uterine contraction and be the cause of the expulsion of the product of conception at any period of utero-gestation.

Infection of fibromyoma is the most common cause of suppuration. Contributing factors, diminishing the power of resistance to invasion and action of germs, are the low vitality of the neoplasm, deficient blood supply of the deeper parts, degenerative changes, and extravasations of blood within the growth.

Streptococcus, staphylococcus, and gonococcus prove active agents of infection.

Gatti (20) reported two cases of suppuration of the central portions of fibroid tumors of the uterus in which bacteriologic examinations of the pus revealed the staphylococcus. Hartman and Mignot (21) recovered a special anærobic bacillus. The source of infection has

been attributed by some writers to the general circulation, but others have contended that this is impossible except by means of septic emboli.

Adhesion of the bowel or of the diseased appendix to the tumor may bring about infection of the growth from the intestinal tract. Suppuration of the uterine appendages is able to furnish the source of pathogenic germs.

In the vast majority of cases the location of entrance of pathogenic germs is the uterine mucosa. The frequency with which labor occurring in women with fibroid tumors of the uterus is complicated by malpresentations, placenta prævia, etc., renders them more liable to infection. Dystocia is often met with in these cases involving the necessity for artificial aid, forceps, or version, and such interference is a well recognized factor of infection. Pathogenic organisms producing septic endometritis are conveyed to the fibromyoma by way of the lymphatic circulation. Septic phlebitis may implicate the neoplasm through the blood-vessels. Other conditions contributing to suppuration have been referred to in the alteration of the blood supply; degenerations and hæmorrhages into the tumor resulting from uterine contraction.

Abortion and miscarriage are frequently incomplete when occurring in the fibromyomatous uterus, and the retained fragments of placental tissue or membranes add to the liability of infection.

Symptoms of suppuration in fibromyoma of the uterus during and after the termination of pregnancy are manifested by increase in volume of the tumor, abdominal pains, fever, accelerated pulse, vomiting, and diarrhœa.

The pain is localized in the tumor; it is of variable intensity, ceasing at intervals and at other times being acute. The intensity of the pains depends upon the degree of peritoneal involvement. Sudden and severe pain with symptoms of collapse is indicative of acute peritonitis. Pain of moderate degree relieved by recumbency would suggest deep seated suppuration, when accompanied by septic symptoms. Fever of variable severity is nearly always present. It may assume a typhoid type, or it may be erratic with exacerbations preceded or not by chilly sensations or rigors. When peritoneal reaction is slight, producing adhesions, it is said that the temperature is irregular. No temperature rise is claimed to exist when a purulent collection has succeeded to aseptic necrosis.

Bearing upon the subject of suppuration of fibromyoma during pregnancy and the puerperium, the following cases have come under my observation and have not been reported previously.

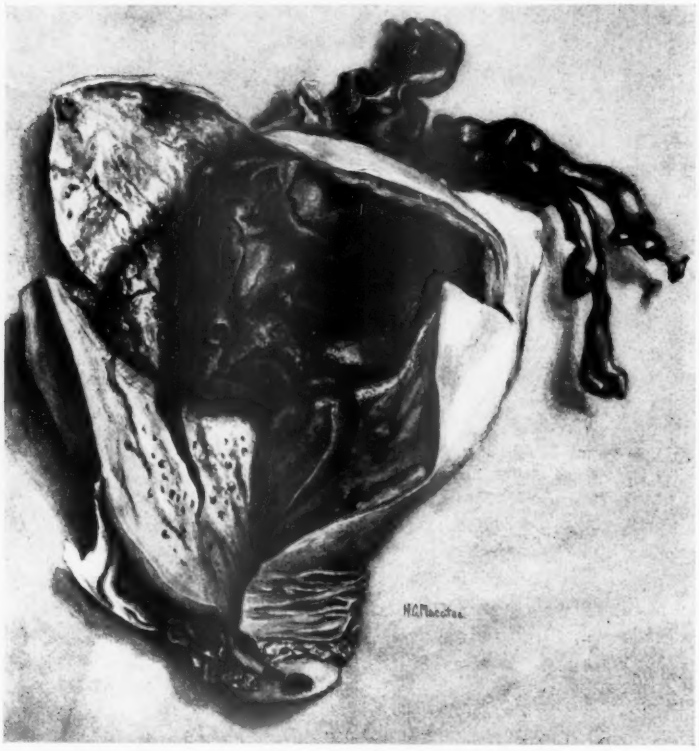
CASE 1. Suppuration and gangrene of fibromyoma. Death 40 days after childbirth. Mrs. B., American, aged 26 years, first came under my observation during the summer of 1904. She was advanced about midway in her first pregnancy, but the uterine development had reached already the proportions of a seven months' gestation. Examination revealed a large interstitial fibromyoma complicating the pregnancy. The neoplasm involved the corpus and fundus of the organ producing uniform enlargement. The woman was anxious to have an infant and also to be rid of the growth. Instead of subjecting her to two risks, first, that of childbirth; and second, the removal of the tumor by a subsequent operation, it was decided to permit pregnancy to advance as near full term as possible and then perform a Porro-Cæsarean section.

On the evening of September 14 ,1904, about two weeks before the anticipated time, labor set in briskly and the patient was brought to my private hospital at 9 P. M. with the dilatation of the os well advanced. The uterine contractions were strong and recurred at short intervals. Labor was progressing normally and rapidly; in consequence of which I decided unfortunately to change the treatment outlined and permitted the birth to terminate naturally. The birth of the infant at 4.10 A. M. September 15th, was followed by a post-partum hæmorrhage. An intra-uterine irrigation of hot sterile water having failed to control the bleeding, the uterine cavity was tamponed with sterile gauze. At 8 A. M. the same morning the pulse rate was 120 and the temperature 99, that evening, 130, and 98.6, respectively. September 16th, A. M., pulse 120; temperature 97.4; P. M., pulse 140; temperature 103.6.

For the following ten days the temperature fluctuated between 99 and 103.4; the pulse between 130 and 140. At noon September 25th, a severe chill was followed by rise of temperature to 105; and on the 26th, another chill with elevation of temperature to 105.6. A septic temperature continued from this time until death on October 25th, a period of forty days. The uterine mass did not undergo reduction of size from the process of involution, but remained large and was sensitive. September 27th, 28th, and 29th, severe pain was complained of in the abdomen extending down the right leg. Other symptoms were nausea, vomiting, and diarrhœa.

The treatment consisted of vaginal and intra-uterine douches; nutritious diet, principally in liquid form; and such supporting remedies as strychnine, quinine, digitalis, whiskey, and champagne.

The autopsy revealed a fibromyoma with a large



Suppuration and gangrene of fibromyoma. Death 40 days after childbirth.

abscess cavity having gangrenous wall and contents. The abscess had ruptured at the fundus of the uterus and finger-like projections extended from it into the peritoneal cavity. There was a general peritonitis with purulent, dirty looking effusion.

One would naturally infer from the history of the case that suppuration of the fibromyoma was caused by infection of the uterine mucosa. The treatment employed for post-partum hæmorrhage, the intra-uterine douche, and gauze tamponade would support such an opinion; on the other hand, the early appearance of symptoms of sepsis with a temperature of 103.6 on the second day of the puerperium might signify that suppuration had preceded and caused the premature labor.

The usual treatment for septic endometritis was promptly instituted but failure to influence the progress of the disease soon led to the suspicion of suppuration within the fibromyoma. Supravaginal hysterectomy was naturally suggested as the method of procedure to save the life of the patient, but her desperate condition from the outset warned me that she could not survive the shock of operation. Dr. I. S. Stone of Washington visited the patient in consultation and agreed that her life would be shortened by such interference; nevertheless I have ever since regretted that I did not take the risk.

CASE 2. Suppurating fibromyoma during puerperium. Supravaginal hysterectomy. This case occurred at Garfield Memorial Hospital, but unfortunately the record has been lost. The patient, a colored woman, was transferred from the obstetric to the gynecologic service. Her infant had been born about two weeks. The fundus of the uterus extended above the umbilicus; the mass was sensitive; the patient presented septic symptoms. Diagnosis, suppurating fibromyoma. Operation, supravaginal hysterectomy. Recovery. On section, the central part of the tumor contained a large abscess which communicated with the uterine cavity by an ulcerated opening 2 x 1 cm.

CASE 3. Sloughing submucous fibromyoma at the seventh month of pregnancy. Foul discharge. Premature labor. Recovery. Mrs. B., white, aged 29 years; had been married ten years; mother of three children. March 14, 1909, she gave birth to a premature infant at the seventh month. For one week before labor she had had fever and passed a foul smelling discharge per vaginam. I saw her in consultation

with Dr. R. C. Ruedy on March 17th, three days after birth of the infant. Her pulse was very rapid (130 to 140) and she had fever and nausea. Vaginal examination. The cervical canal was dilated and passing the middle finger through to the uterine cavity, a sloughing mass could be felt at the fundus. The placenta had been expelled naturally.

Diagnosis: septic fever; soughing submucous fibroid. The critical condition of the patient contraindicated surgical interference. Antiseptic intra-uterine douches and general supporting treatment was followed by improvement and gradual restoration to health.

In the twenty-three cases of suppuration of fibromyoma collected by M. G. Berger (22), one of them is not clearly associated with pregnancy (case 6). Abortion or miscarriage occurred nine times (cases 3, 5, 7, 9, 12, 15, 16, 18, 21). In the majority of the cases suppuration followed the termination of uterogestation, spontaneous as well as artificial. Septic symptoms (rapid pulse, fever and diarrhœa)were noticeable before or soon after the abortion. In one case (21) the suppuration and septic symptoms began one month after conception and continued until four and a half months of gestation. The patient died of peritonitis on the ninth day after miscarriage. The tumor contained three liters of pus. In the third case of the series, sepsis developed four months after miscarriage. Two and a half liters of pus were removed by tapping the tumor; hysterectomy was afterwards performed and the patient recovered. In two cases (5, 7) after curettage had failed to relieve the symptoms, hysterectomy was performed successfully.

Three of the nine cases recovered and six died. The recoveries were all cases upon whom hysterectomy had been performed (3, 5, 7). In the six fatal cases no operation had been performed except that in one the uterus had been emptied.

Thirteen of the twenty-two cases followed premature or full term labors, with three recoveries and ten deaths.

In the three cases that recovered, one opened spontaneously and discharged pus through the abdominal wall (case 1); one discharged pus *per vaginum* for twelve days at the fifth month of pregnancy, was delivered artificially at the eighth month, and made a good recovery with disappearance of the fibromyoma (case 2); one had pain, vomiting, and diarrhœa for one month after childbirth. The necrotic and suppurating tumor was opened and drained successfully (case 4).

Suppuration of fibromyoma during puerperium. Supravaginal hysterectomy. Recovery.

The fatal cases presented difficult labors, and the frightful mortality when treated by delivery through the natural passages emphasizes the importance of early Porro-Cæsarean section. Cases of suppuration of fibromyoma after childbirth should be treated by prompt performance of supravaginal hysterectomy. A valuable lesson is taught in these cases by the disastrous result of delay and attempts to deliver by obstetric methods.

REFERENCES

1. KELLY AND CULLEN. Myomata Uteri. 1909. p. 431.
2. VIRCHOW, R. Die Krankhaften Geschwülste, 1863, bd. iii, s. 107.
3. KELLY. Operative Gynecology, New York, 1898, vol. ii, pp. 343, 344.
4. NOBLE, C. P. Journ. Am. Med. Assn., December, 1906, p. 1881.
5. CORNIL. Bulletin Académie de Medicine, February 7, 1893.
6. COHN, H. Myoma and Pregnancy. Inaug. Diss., Egeln, 1906.
7. ARNHEIM, B. F. Inaug. Diss., Frankenthal, 1904.
8. ALLMELING, O. Inaug. Diss., Lauenburg, 1904.
9. LUSK. Science and Art of Midwifery, New York, 1892, p. 138.

10. JEWETT. The Practice of Obstetrics, Phila., 1907, p. 201.
11. SUTTON, J. BLAND. Pregnancy and Uterine Fibroids. The Clin. J., 1904, xxiv, p. 145.
12. STEINBÜCHEL. Weiner Klin. Wochenschrift, xvii, No. 37, s. 945.
13. STEIN. Monatsch. f. Geburtsh. Gynäk., xxii, No. 5, s. 637.
14. SCHENK. Necrosis of Myomata during Pregnancy. Ventrlbl. f. Gynäk., Leipz, 1908.
15. MALCOLM, J. D. Sloughing of a Fibromyoma. Trans. Obst. Soc., London (1904) 1905, xlvi, 15.
16. NUSSBAUM, J. Fibromyoma during Pregnancy and the Puerperium. Wien. Klin. Therap. Wchschr., 1904, xi, 18.
17. SCHULTZE. Monatsch. f. Geburbach. Gynäk., xxv, 761.
18. KRUGENBERG. Arch. f. Gyn., 1883, xxi.
19. NEUGEBAUER, LUDWIG. Monatschrift für Geburtsk, No. 28, 1866, p. 401.
20. GATTI. Il Policlinico, Roma, 1895, t. ii, Chirurgie, p. 324.
21. HARTMAN AND MIGNOT. Annales de Gynécologie, Juin, 1896.
22. BERGER, M. G. Thèse. Suppuration des Fibrome au Cours de la Puréperalité, Paris, 1907.

THE RELATIONSHIP BETWEEN THE THYROID AND PARATHYROIDS[1]

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SINCE the re-discovery of the parathyroid glandules by Gley (1) in 1893, great interest has been taken in these organs. This interest was confined largely to physiologists and pathologists for a decade or more, but more recently it has been shared by surgeons and the references to these glandules are becoming very numerous. Escherich (2) claims that tetanoid conditions in children receive their explanation from a study of the pathology of the parathyroid glandules. In his clinic in 89 infants in an unselected series the parathyroid bodies were injured by hæmorrhage in 39 cases and the severity of the clinical symptoms was in direct proportion to the severity of the pathological changes in the parathyroids. He thinks the hæmorrhage probably occurs as the result of trauma at the time of birth. Berkeley (3), Lundborg (4), and Frommer (5) claim therapeutic benefit from the administration of an extract of the glandules in cases of paralysis agitans.

Schirmer (6), after an extensive review of the literature, says the logical conclusion is that the function of these glandules is a toxin neutralizing one. On this basis he proposes to treat defective functioning by a specific antitoxin. Working on these lines, Leischner (7) transplanted the parathyroids in rats to overcome tetany in parathyroidectomized animals. Edmunds (8), Vassale (9), Lusena (10), and MacCallum and Davidson (11) also report varying degrees of success, where parathyroid was administered to animals suffering from tetany following parathyroidectomy. The method of administration was by the mouth or by injecting an emulsion subcutaneously or intravenously. The last named authors administered to a dog the parathyroids of 112 dogs and several cows in 15 days and failed eventually for want of a supply. Berkeley and Bebe (12) recently reported having separated the protein of the gland into three parts called nucleo-protein, globulin, and albumin. The former, they claim is equal to the whole gland, the other two being useless in relieving tetany. From the use of the nucleoprotein they claim success in ninety-five per cent of the trials in experimentally induced tetany in dogs. In the case of the human subject, Pool (13) reports a case of tetany following thyroidectomy where beneficial results are said to have followed the administration of parathyroid extract.

The operation for goiter is now being carried out with a view to avoiding injury to the parathyroid glandules. Halsted and Evans (14) made a very careful study of the blood supply of these glandules and described a method of operation whereby the glandules are not disturbed; Geis (15) has reported similar work, and coming to the practical application in his article says, "I believe that, with a proper operation and careful dissection, the whole

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thyroid gland can be removed without causing tetany. The essential thing in the operation is to recognize the parathyroid glands and their blood-vessels. Neither of these must be injured." This would imply that he regards ablation of the whole thyroid as being a safe procedure, the only anxiety being that of saving the parathyroid glandules intact.

These and many other attempts at making a practical application of the facts available regarding the parathyroid glandules induced the present writer to undertake a series of experiments with the object of confirming or otherwise the statements of the several authors as to the functional importance of the parathyroid glandules and their physiological relation to the thyroid gland.

The views at present most widely accepted as regards the effect of removal of the thyroid and parathyroid glands are, I think, fairly stated thus: Parathyroidectomy is invariably and rapidly fatal; thyroparathyroidectomy is less rapidly fatal than is ablation of the parathyroid glandules alone. Kocher (16), Lusena (10), Vassale and Generali (17), and MacCallum and Davidson (11). Thyroidectomy alone in, probably all vertebrates, Jeandelize (18), is followed by a series of chronic nutritional changes when the behavior of the animal is altered and sluggish, the skin becomes thick and œdematous, the hair becomes coarse and falls out and in young animals growth is interfered with so that the animal remains stunted; and finally that, though these two organs are functionally associated with one another, neither one can assume the functions of the other, and that under no circstances does the histological structure of the one approach that of the other. Thus it is seen that the parathyroid glandule is generally regarded as having a more vital function than the thyroid gland.

This effort at making a practical application of our present knowledge of the relation between these two sets of glands is to be commended, particularly such work as that of Halsted and Evans. From the results I obtained in this series, however, some of the foregoing statements regarding the relative importance of the two organs cannot be confirmed, and some of the practical conclusions referred to seem premature and unwarranted.

In this series, twelve cats, twenty-five dogs, and twenty-five rabbits were operated on. In these animals the operation of parathyroidectomy without very severe injury to the thyroid gland is very frequently impossible, owing to the internal parathyroid glandules being so deeply imbedded in the substance of the thyroid; and conversely, a thyroidectomy is still oftener an impossible operation if the parathyroid glandules are to be left intact. From a study of the literature, one is not led to look for this difficulty. Welsh (19) and Vincent and Jolly (20) are amongst the few who mention the surgical difficulty in some cases and the impossibility in others. In twelve cats I was unable to perform a thyroidectomy more than once leaving even one parathyroid uninjured, and in 25 dogs this was possible only once (dog 4) where two parathyroids were preserved with blood supply intact. In rabbits it is usually an easy matter to preserve the two external parathyroids, but it is very difficult to remove all shreds of the thyroid, as in fully one-third of the cases, the recurrent laryngeal nerve passes through the gland on one or both sides, and it is indeed quite a difficult surgical procedure to remove all shreds of the thyroid without injury to the nerve.

Removal of all the parathyroids, allowing the whole thyroid to remain, is also a difficult procedure. In the twelve cats I was able to do this only once, and in twenty-five dogs six times. In only one rabbit out of twenty-five (rabbit 10) was it possible to perform a parathyroidectomy, and in that instance on one side only; on the other side the lobe of the thyroid had to be removed to secure the internal parathyroid.

I have been unable to confirm the statement that complete parathyroidectomy invariably proves fatal, and that in a short time. In dogs 3 and 7, where serial sections of the thyroid removed post-mortem showed no parathyroid, the animals lived 30 and 27 days respectively without symptoms, and were killed. In dog 1, symptoms did not occur, and at the post-mortem no parathyroids were found, although serial sections were not cut. In cats 1, 6, and 8,in which at the operation the thyroid lobe with

the parathyroids on one side, and the parathyroids alone on the other side, were removed, the animals lived, without symptoms, 23 days, 25 days, and 30 days respectively, and were then killed. In all three cases a careful postmortem search was made, and the remaining lobe of the thyroid was cut in serial sections, and no traces of parathyroid was found. There is a tendency to disregard these exceptions—MacCallum and Davidson (11), Berkeley and Beebe (12)—and explain them by supposing that parathyroids have remained behind unobserved. All I can say is that the most careful search was made, and serial sections of the remaining thyroid lobe or lobes prove conclusively that no parathyroids were left in these lobes. Whether or not any accessory glandules were present in the thorax or some other part of the body, I am unable to say. Moreover, as Vincent (21) observes, "If accessory glands be so usually present, then the question as to the importance to life of these glands ceases to have the value hitherto attached to it."

Again, I have not been able to confirm another generally accepted statement, viz.: that parathyroidectomy alone is a more rapidly fatal operation than thyro-parathyroidectomy. In my experiments, death occurred earlier on the average with the complete operation than with parathyroidectomy. In cat 3, where a complete operation was carried out, death supervened in 30 hours; in cat 10, during the fourth day, and in cat 7, early in the fifth day. In those experiments, on the other hand, where a parathyroidectomy was performed, the following results were obtained: In cat 4 death occurred on the fifth day, but cats 1 and 6 were killed on the 23d and 35th days respectively and no parathyroid tissue was found when serial sections were cut.

In those rabbits submitted to the complete operation, one death supervened in 32 hours (rabbit 20), one in 43 hours (rabbit 21), two during the second day (rabbits 11 and 12), and one on the third day (rabbit 18).

Since in only one case (rabbit 11) was simple parathyroidectomy possible, this operation cannot well be compared with the complete operation in this animal, but in the case of the dog, in my hands, only one animal (dog 4) out of eight in which all parathyroids have presumably been removed, died of tetany and that on the 23d day. In two of the remaining seven (dogs 3 and 7) serial sections revealed no parathyroids left at operation.

Horsley (22) was the first to report operative myxœdema in experimental work, having observed it in the monkey. Murray (23) and Edmunds (24) later agreed with him on this point. Vincent and Jolly (20) were unable to confirm these findings after 13 complete extirpations on monkeys. This is similar to the report of Munk (25) and Kishi (26). In my series of experiments I have been unable to produce myxœdema in the dog, cat, or rabbit.

In dog 5, after thyroidectomy, the animal lived in apparently normal health, and on the eighty-third day the two parathyroids which were allowed to remain at the first operation, were removed, and the animal lived till the one hundred and twenty-seventh day. Up to the one hundred and fifth day no symptoms developed; from that time the animal suffered from sore eyes, a running nose, general weakness and loss of flesh, and died on the one hundred and twenty-seventh day. There was no increase of fat in the subcutaneous tissue, the hair did not fall out, the skin was not more waxy and dry. Neither were any of these symptoms observed in rabbits 16 and 18, which lived 86 and 82 days respectively, without symptoms, and were killed.

The majority of physiologists and pathologists hold to the view that the thyroid and parathyroid are two separate and independent organs, and that this independence is both anatomical and physiological. Recently, however, views very like those held by some of the earlier observers have been revived by Kishi (26), Vincent and Jolly (20), and Forsyth (34). These observers, without denying the possibility of a certain degree of functional independence, belonging to thyroid and parathyroid respectively, are nevertheless strongly of the opinion that there is a definite physiological relationship, and that in many ways they may be looked upon as constituting a single piece of apparatus.

This view is also strongly supported by a histological study of the thyroid and parathy-

roid and by changes in the latter which occur after removal of the former. Thus Vincent and Jolly found that in the cat a parathyroid left behind after thyroidectomy, changed its structure so as to approximate to that of the thyroid. In the dog, Mrs. Thompson and myself (27) have recently reported similar but more marked changes in a parathyroid of a dog left behind after removal of the thyroid (see Figs. 1 and 2), and I have to report a quite recent case of the same phenomenon in the rabbit (rabbit 19).

In this case, in which an attempt was made to extirpate thyroid and parathyroid in toto, the animal survived 45 days without symptoms and was then killed, but at the post-mortem

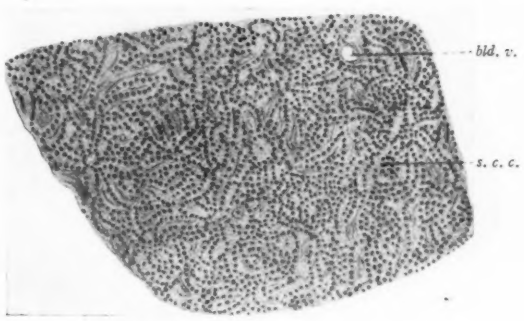

Fig. 2. Normal parathyroid of dog. ×120. *s.c.c*, Solid columns of cells. *bld. v*, Blood-vessel. To be compared with Fig. 1. (Halpenny and Thompson, Anat. Anzig., band 1909.)

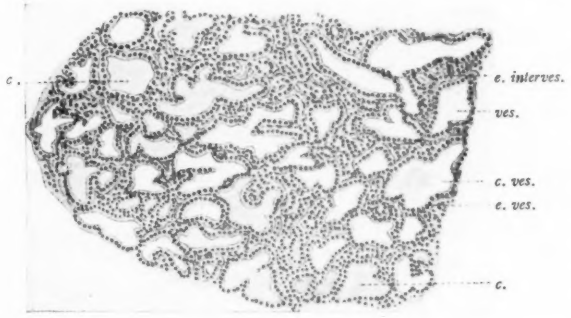

Fig. 1. Parathyroid of dog, eighty-three days after thyroidectomy, showing vesicles, some of which contain colloid. ×120. *c*, Colloid. *e. interves*, Intervesicular epithelial tissue. *ves*, Vesicle. *c. ves*, Colloid vesicle. *e. ves*, Epithelium lining to vesicles. (Halpenny and Thompson, Anat. Anzig., band 1909.)

examination shreds of glandular looking tissue were found in the former situation of the external parathyroid and these, on microscopical examination, showed distinctly the first stages of transformation into thyroid tissue. Nearly all the portions of parathyroid tissue revealed minute cleft-like spaces. In other portions of the tissue small rounded spaces lined by a regular circle of cells were to be seen, and in still other regions, especially at the edge of the parathyroid, were typical, large colloid vesicles. In another rabbit (rabbit 15), which died forty-three days after removal of the thyroid, with both external parathyroids left in situ, no changes had occurred in these glandules. In rabbit 16, which lived 86 days with both external parathyroids left in situ, no symptoms occurred, the animal was killed, and no changes were found in the parathyroids, either macroscopically or microscopically. This was the result also in rabbit 19, living 82 days with only one parathyroid. There were no symptoms of myxœdema in any of these animals. Thus it will be seen that the results are not uniform, and one cannot account for this variation. It would seem, however, that under certain conditions yet unknown, the parathyroid changes in structure so that it ap-

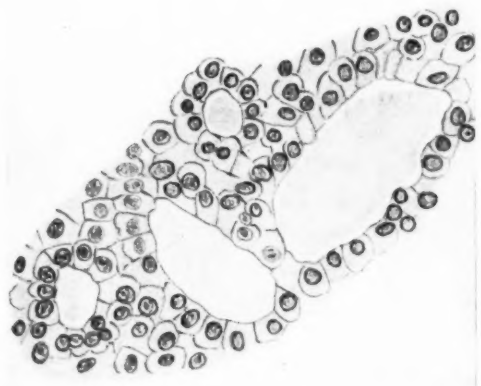

Fig. 3. Pituitary, pars intermedia. Dog after parathyroidectomy. Flemming. From H. and E. camera lucida × 350.

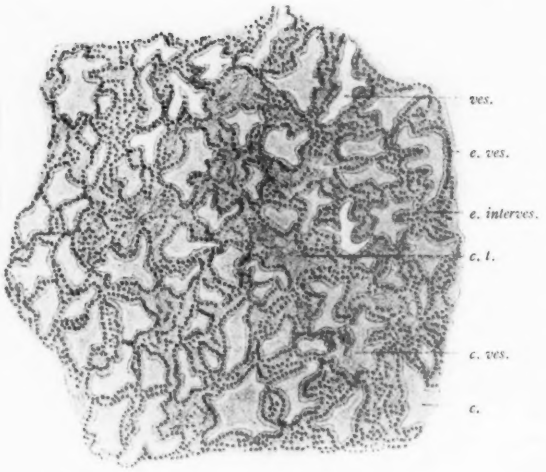

Fig. 4. Thyroid of dog, thirty-two days after removal of all four parathyroids. The vesicles have become very irregular in shape and there seems to be an increase in the intervesicular epithelial tissue. × 120. *ves*, Vesicle. *e. ves*, Epithelium lining vesicles. *e. interves*, Intervesicular epithelial tissue. *c. t*, Connective tissue. *c. ves*, Colloid vesicle. *c*, Colloid. Compare with Fig. 5. (Halpenny and Thompson, Anat. Anzig., band 1909.)

proximates very closely in structure to that of the thyroid.

In animals dead after parathyroidectomy Vassale and Donaggio (28) describe changes in the spinal cord. They say "Zones of degeneration in the lateral and posterior columns may be seen with the naked eye, but better after staining with nigrosin." I have been unable to confirm this. (See protocols, dog 4.)

Changes in the pituitary body have been described by Herring (29), occurring in two rabbits after thyroidectomy. In the anterior lobe there was no change. "Remarkable changes are at once apparent in the posterior lobe, and particularly that portion of it which lies next to the pars intermedia, masses of a colloid nature lie among the cells and fibers of the pars nervosa. In the neck of the posterior lobe, the colloid is even more plentiful." Rogowitsch (30) in 1889 had already stated that the pituitary acts vicariously for the thyroid. Other observers (31, 32, and 33) have noted the same phenomenon consequent on disease or removal of the thyroid.

In dog 4 of my series, where all parathyroids were removed, similar changes occurred, with the slight difference that in Herring's cases the colloid was found partly in the pars intermedia. The essential point, however, is that in his case of thyroidectomy, and in my case of parathyroidectomy, very similar changes occurred in the pituitary body.

There is a marked increase in the normal amount of colloid found in the pituitary (see Fig. 3) with a somewhat regular formation of the containing vesicle, which has a distinct layer of lining cells. This, to my mind, is distinct evidence of a close relationship between the thyroid and parathyroid and that their functions are similar, not antagonistic or corrective of one another. In conclusion I submit that many instances occur where a presumably complete parathyroidectomy is not followed by tetany, and that parathyroidectomy is not more fatal than thyro-parathyroidectomy. Evidence has been given to show that the histological structure of the thyroid after parathyroidectomy is very similar to the structure of parathyroid following thyroidectomy. The changes occurring in the pituitary body following thyroidectomy resemble those succeeding parathyroidectomy. This all seems to

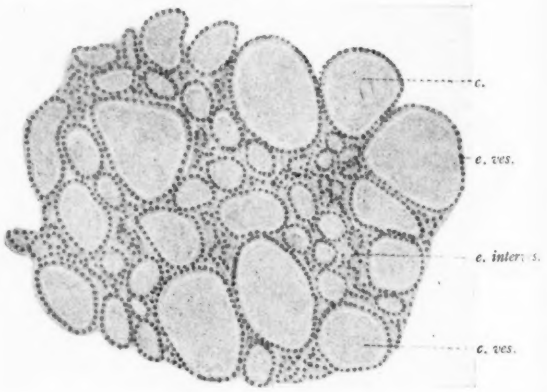

Fig. 5. Normal thyroid of a dog, for comparison with Fig. 3. *c*, Colloid. *e. ves*, Epithelium lining vesicles. *e. interves*, Epithelial intervesicular tissue. *c. ves*, Colloid vesicle. × 120. (Halpenny and Thompson, Anat. Anzig., band 1909.)

point strongly toward some very close relation between these two glands, and that in some instances at least, each is able to assume the functions of the other to a greater or less extent.

Though the parathyroid glands are not rudimentary thyroids, the whole apparatus is essentially one. Its function has to do with metabolism, and the acute symptoms, as well as the chronic when they occur, are due to a lesion sufficiently severe to impair its integrity.

PROTOCOLS

Dog 1. Four parathyroids and a doubtful body removed. Lived in perfect health, killed on 23d day. At post-mortem the thyroid lobes were removed and serial sections cut. No parathyroids were found.

Dog 2. Five parathyroids removed. Lived 31 days with no symptoms. Killed. Thyroid normal. Serial sections cut. One parathyroid found in the substance of the thyroid.

Dog 3. Four parathyroids removed and verified by the miscrocope as having their capsules complete. Lived 30 days without symptoms. Killed. Thyroid removed and serial sections cut. No parathyroids were found.

Dog 4. Three parathyroids seen on each side and removed. For two days seemed well. On the third day was ill, the hind legs were stiff. On the fifth day started attacks of tetany, commencing with a cough. Marked irritation of the nose. Drank with great difficulty. On the seventh day had coryza and the cough was worse. Tetany came on at intervals during the day. In the evening was moved to a hot room and nearly succumbed to attack of tetany. The respirations reached 275 per minute and the pulse was uncountable. In about five minutes animal became easier, and respirations dropped to eight or ten per minute. Moved to a cool room and seemed fairly well, though choked considerably while eating bread and milk. Walked with an unsteady gait. By the tenth day was considerably better, though there were several attacks of tetany each day. From the twelfth to the twentieth day was not observed to have any attacks of tetany. On the twenty-first day fits returned and from then till death occurred, on the thirty-third day, had several attacks of tetany each day. Died in convulsion. At post-mortem thyroid was slightly hypertrophied. No parathyroids could be found, though careful search was made by Prof. Swale Vincent. The spinal cord and the pituitary body were removed for microscopic examination. The thyroid gland on microscopic examination showed a marked change. The shape of the vesicles was very irregular and the amount of the colloid was much less than normal. The intervesicular tissue of the gland had approached that of a normal parathyroid with its solid column of cells. (Figs. 4 and 5.) The spinal cord was treated according to the method described by Vassale and Donaggio (28). It was fixed in Muller's solution for four months, dehydrated in alcohol, stained in nigrosin, differentiated in alcohol and mounted in Canada balsam. No changes were found. The pituitary body was preserved in Flemming's fluid. There was a striking change in the pars intermedia. The layer of epithelial cells, reflected over the nervous portion of the gland, was much hypertrophied and contained numerous vesicles in all respects resembling those found in the normal thyroid. (Fig. 3.) The vesicles were lined with a regular circle of epithelial cells, precisely as in the thyroid. The colloid contents seemed to be of the same character as in the thyroid and appeared to give the same microchemical reaction.

Dog 5. This experiment has already been reported (27). An external parathyroid was found on either side with blood supply such that they could be allowed to remain while the thyroid and internal parathyroids were removed. Remained in good health for 83 days. The temperament seemed changed; it was more playful with people and much more quarrelsome with other dogs. On the 83d day the parathyroids were removed. The right gland has hypertrophied very markedly and the left less so. For three or four days animal was slightly ill, but gradually improved. From that time it continued in about its usual health till the 105th day, when it was observed to be less playful and had sore eyes. The appetite became worse and the animal grew weak and idiotic. From the 121st day constant tremors of the larger muscles were observed, but at no time were convulsions seen, though the animal was kept under closest observation from morning till night. This condition became worse till death occurred on the 127th day. At the post-mortem careful search was made by Professor Swale Vincent and no thyroid tissue or other parathyroids could be found. "The two parathyroids which had been left behind were found to have hypertrophied, and each of them showed on microscopic examination the appearance depicted in Fig. 1. They had, to all intents and purposes, become converted into thyroid. There was still a comparatively large amount of intervesicular tissue which was identical with that of the solid columns forming the normal parathyroid. The vesicles are irregular in shape, though each is surrounded with a regular row of epithelial cells. Colloid is scarce in these vesicles, though it is undoubtedly present in some of them." (27.)

Dog 6. Four parathyroids seen and removed, all verified by microscope, having capsule complete. Lived 28 days. No symptoms. Killed. Serial sections of thyroid. One parathyroid found in substance of left lobe.

Dog 7. Four parathyroids seen and removed, all verified by microscope, having capsule complete. Lived 27 days. No symptoms. Killed. Thyroid examined by cutting serial sections, and no parathyroid tissue was found.

Dog 8. On left side two bodies were removed. On microscopic examination one was reported parathyroid and one a piece of thyroid. On right side whole apparatus was removed. Animal lived 28 days without symptoms. Killed. At post-mortem no parathyroid tissue was found.

Dog 9. Two parathyroids seen on left side and removed. Neither parathyroids were seen on the right side and the thyroid lobe was removed. The animal lived 15 days without symptoms. Killed. No parathyroids were found, but no microscopical examination was made.

Dog 10. Complete operation. On the third day the animal had rapid respirations and stiffness of the legs. The following day had several spells of tetany and was sacrificed on the seventh day while in a convulsion.

Dog 11. Four parathyroids were seen and removed. Dog lived 12 days without symptoms. Killed. No parathyroids were found. Post-mortem, but no microscopical examination was made.

Dog 12. Four parathyroids seen and removed. On the fourth day had rapid respirations and hind legs were very stiff. On the fifth day the respirations reached 120 per minute and there was distinct twitching of the muscles. Animal was not observed in a convulsion, though under constant observation all day. By the eighth day it had recovered and lived without further symptoms till the twenty-first day, when it was sacrificed. At post-mortem no parathyroids were found; microscopical examination, however, was lacking.

Cat 1. Three parathyroids seen on right side and removed. Verified by microscope, having capsule complete. No parathyroids seen on left side. This lobe of the thyroid was removed completely. Lived 23 days. No symptoms. Killed. Right thyroid removed and found much atrophied. Cut in series but no parathyroid tissue was found. On the left a small body was thought to be a parathyroid and was removed. On microscopic examination it was found to be a lymphatic gland.

Cat 2. The right lobe of the thyroid removed; external parathyroid left in situ with good blood supply, but the internal parathyroid was seen and removed, with the lobe of the thyroid on the left side; here blood supply of external parathyroid was so intimate with that of the thyroid, they were removed together. For two days animal was well, third day lay quietly in cage, fourth day nervousness commencing, fifth day tetany commenced, and death in tetany occurred on the sixth day. At post-mortem the parathyroid was found and miscroscopically appeared normal.

Cat 3. No internal parathyroids were seen. The external parathyroids were seen, having blood supply intimate with that of the thyroid. The whole apparatus was removed. The following day had typical tetany and died in tetany 30 hours after operation. Neither thyroid nor parathyroid tissue was found post-mortem.

Cat 4. The right lobe of the thyroid was removed with two parathyroids. On the left side two parathyroids were seen and removed, the lobe of the thyroid was left in situ. On the third and fourth days animal had typical tetany, and on the fifth day died in tetany. Thyroid removed at post-mortem and cut in series. No parathyroid tissue was found.

Cat 5. Four parathyroids seen and removed. Remained well 39 days. Killed. Serial sections cut of the thyroid. A parathyroid was found in the substance of right lobe of the thyroid.

Cat 6. On the right side, two parathyroids seen and removed. On the left side only one parathyroid seen, and this, with the lobe of the thyroid, was removed. Animal remained well for 35 days. Killed. At post-mortem right lobe of thyroid was removed, also small body on left side. Serial sections of the former revealed no parathyroid, and the latter proved to be a lymphatic gland.

Cat 7. Only two parathyroids were seen; the whole apparatus was removed. On the second day had some slight signs of tetany. On the third day was worse, and died in tetany early the fifth day. At post-mortem neither thyroid nor parathyroid tissue was found.

Cat 8. On the left side two parathyroids were seen and removed. On the right side no parathyroids were seen, and the whole lobe of the thyroid was removed. Animal remained well for 30 days. Killed. Left lobe of thyroid removed. Serial sections cut, when a large parathyroid was found.

Cat 9. Four parathyroids were seen, but were not surgically removable. Animal killed under anæsthetic.

Cat 10. Only one parathyroid could be located. This, with the thyroid, was removed. The animal was quite ill from the time of the operation. Refused to eat. Fore limbs flexed; hind limbs stiff. Had tremors commencing the second day and died in typical tetany early the fourth day. At post-mortem, neither thyroid nor parathyroid tissue was found.

Cat 11. Could locate only one parathyroid on either side. Nothing removed, but the thyroid was crushed throughout with tissue forceps. The animal lived 21 days without any symptoms. Killed. At the post-mortem the thyroid was badly damaged but much normal tissue remained.

Cat 12. Thyroid and parathroids removed. On the second day had stiffness of the legs, but no tetany. On third day nervous symptoms were more marked. Killed on the fourth day during an attack of tetany because wound was slightly septic. At the post-mortem neither thyroid nor parathyroid tissue was found.

Rabbit 1. Thyroid removed completely. Both external parathyroids were seen about three-eighths inch away from the thyroid and left in situ with good blood supply. Died the following day without convulsions. At post-mortem external parathyroids were found intact.

Rabbit 2. Thyroid removed completely. The left external parathyroid was seen three-eighths inch away and was preserved with good blood supply. The right external parathyroid was close to the thyroid and in catching a bleeding point its blood supply was damaged, but it was left in situ. Animal remained well for 19 days. Died on the twenty-fifth day without symptoms of tetany. Post-mortem by F. D. Thompson. The left external parathyroid was found with good blood supply. The right external parathyroid had its blood supply cut off.

Rabbit 3. The thyroid was removed completely. The left external parathyroid could not be saved. The right external parathyroid was preserved with a

good blood supply. The internal parathyroids were not seen. (Note made at operation: Right recurrent laryngeal nerve cut.) The animal died the second day. At the post-mortem the right recurrent laryngeal nerve was found cut.

Rabbit 4. The internal parathyroids were not seen. The external parathyroids were very close to the thyroid. The left recurrent laryngeal nerve ran through the thyroid. The thyroid and all parathyroids seen were removed. The animal lived 39 days without symptoms. Killed. At the post-mortem a bit of thyroid was found on either side of the larnyx. There was apparently not much hypertrophy of the thyroid, as only minute shreds were found. No parathyroids were found.

Rabbit 5. The thyroid was removed completely. Both external parathyroids were seen and left in situ with good blood supply. The animal lived 50 days without symptoms. Killed. No parathyroids could be found and no thyroid tissue remained. One body, removed for examination, proved to be lymphoid tissue.

Rabbit 6. The thyroid was removed completely. Both external parathyroids were seen and saved with a good blood supply. The recurrent laryngeal nerve on the left side was accidentally injured with forceps. The animal died the following day, having difficult respiration, but no tetany.

Rabbit 7. Both external parathyroids were preserved with a good blood supply. The thyroid was removed with the internal parathyroids. The animal lived in good health for 33 days. Killed. The parathyroids were not distinguished at post-mortem. Four bodies were removed for examination. On microscopic examination they proved to be lymphoid tissue.

Rabbit 8. The parathyroids were not seen on either side. The thyroid was removed completely. For four days the animal was well. Then breathing became rapid, but no tetany was observed. Died in seven days without tetany.

Rabbit 9. The whole apparatus removed because the blood supply of the parathyroids was intimate with that of the thyroid. The animal remained well for 37 days. Then for two days it was not well and was found dead in cage. Never observed to have any tetany. At post-mortem, by F. D. Thompson, no thyroid or parathyroid tissue was seen. One body removed, proved under microscope to be a lymphatic gland.

Rabbit 10. On the left side the whole apparatus removed. On the right side two parathyroids were seen and removed. The animal lived 30 days without symptoms. Killed. At the post-mortem no parathyroid tissue found. Serial sections were not cut.

Rabbit 11. On the right side the external parathyroid was clearly visible and was removed. On the left side no parathyroid was seen, though search was made from the sternum up. The thyroid was removed completely. The animal died early third day. It was never observed in tetany. At the post mortem neither thyroid nor parathyroid tissue was found.

Rabbit 12. An external parathyroid was easily found on either side. Both were removed with thyroid The animal died early third day without being observed in tetany.

Rabbit 13. The thyroid and parathyroids were removed. The left recurrent laryngeal nerve ran through the thyroid and was injured with resulting respiratory disturbance during the rest of the operation and during the rest of life. Up till the seventh day seemed in fair health, ate very heartily, and was never observed to have tetany, but died that night.

Rabbit 14. The thyroid was removed and the external parathyroids were left in situ with good blood supply. Died of chronic symptoms on the forty-third day. At post-mortem no thyroid tissue was found. The parathyroids easily located. Microscopical examination revealed no changes in them.

Rabbit 15. The thyroid was removed completely, and both external parathyroids were left in situ. The animal lived 86 days without symptoms. Killed. There was no increase in the subcutaneous fat. Marked ascites was present. Both external parathyroids were easily found, but no thyroid tissue remained. Microscopical examination of the parathyroids revealed no change.

Rabbit 16. The thyroid was removed completely, also the left external parathyroids, while the right external parathyroid was left in situ. Remained apparently as well as ever till the fifty-first day, when tetany developed and death ensued one and a half hours later. The right external parathyroid was easily located, and from gross appearance did not seem to be hypertrophied. Its artery was intact. Serial sections revealed no change in its histological structure.

Rabbit 17. The thyroid, with the left parathyroid was removed. The right parathyroid was left in situ with good blood supply. Lived 82 days without symptoms. Killed. The right external parathyroid easily found. No thyroid tissue present. There was no increase in the subcutaneous fat; there was slight ascites. The parathyroid examined microscopically showed no change.

Rabbit 18. The thyroid and all the parathyroids removed. In 20 hours the animal had tremors and the fore legs were flexed. The following day it was observed in tetany and died during the third day, of tetany. At the post mortem no thyroid or parathyroid tissue was found.

Rabbit 19. Complete operation. The animal lived 45 days without symptoms. Killed. At the post-mortem careful search was made for thyroid and parathyroid tissue. Three small bodies, removed from the former situation of the parathyroids, on microscopic examination proved to be lymphatic glands.

Rabbit 20. Complete operation. The external parathyroids were very large. The animal died of tetany in 32 hours. The post-mortem revealed nothing.

Rabbit 21. The left external parathyroid was superficial to the muscles. The isthmus of the thyroid covered five rings below the larynx. A complete operation was done. The animal had typical tetany during the second day and died 43 hours after operation. Post-mortem revealed nothing.

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REFERENCES

1. GLEY. Arch. de. Physiol. 5 sér. v, p. 766. 1893.
2. ESCHERICH, T. "Tetanoide Zustände des Kindesalters." Münchener Med. Wochenschrift, October 15, 1903. Liv. No. 42.
3. BERKELEY, W. N. "A brief report of further experiments in the use of Parathyroid gland in Paralysis Agitans." Medical Record, New York, November 9, 1907.
4. LUNDBORG. Deut. Zeit. F. Nervenheilk, xxvii, 1904, p. 217.
5. FROMMER. Monatsh., f. Geb. u. Gynak., xxiv, 1906, p. 748.
6. SCHIRMER, K. H. "Rolle der Epithelkarperchen," Central für die Greuzgebiete der Med. und Chir., Jena, x, No. 13, p. 481, 1907.
7. LEISCHNER. Wien. Klin. Wochenschr., xx, p. 645, May 23, 1907.
8. EDMUNDS. British Med. Jour., 1901.
9. VASSALE. Rev. Ser de Frematria, 1890.
10. LUSENA. Fisio-patologia dell' Apparecchio Tiroparatiroideo, 1899, p. 108.
11. MACCALLUM and DAVIDSON. "Further notes on the Function of the Parathyroid glands." Medical News, Ap. 8, 1905.
12. BERKELEY and BEEBE. "The Physiology and Chemistry of the Parathyroid gland." Jour. Med. Res., vol. xx, No. 2, Feb., 1909.
13. POOL, E. H. "Tetany para thyroipriva." Annals of Surgery, vol. xlvi, No. 4, p. 507.
14. HALSTED, W. S., and EVANS, H. M. "The parathyroid glandules, their Blood Supply and their Preservation in Operation on the Thyroid Gland." Annals of Surgery, vol. xlvi, No. 4, Oct., 1907, p. 489.
15. GEIS, U. P. "The Parathyroid Glands." Annals of Surgery, vol. xlvii, p. 523, 1908.
16. KOCHER, A. Keen's Surgery, vol. iii, p. 342, 1908.
17. VASSALE and GENERALI. Archives Italiennes de Biologie, 1900, tome xxxiii, p. 154.
18. JEANDELIZE. "Insuffisance thyreoidieme et parathyroidieme," Paris, 1903.
19. WELSH. Jour. of Anat. and Physiol., 1898, p. 380; Jour. of Path. and Bact., 1898.
20. VINCENT and JOLLY. Jour. of Physiol., vol. xxxii, 1904, p. 65, and vol. xxxiv, 1906, p. 295.
21. VINCENT, SWALE. Internal secretions and the Ductless glands. The Lancet, Lond., Aug. 11 and 18, 1906.
22. HORSLEY. Proc. of the Royal Society, 1884, No. 235 and 1886; Brit. Med. Jour., 1885, Jan. 17–31. Internat. Central f. Laryngologie, July, 1885. Comptes Rendus des Séances, de la Soc. de Biol., Dec., 1885. Report of the Myxœdema Committee of the Clin. Soc. of Lond., 1889; Lancet, Dec., 1886; Brit. Med. Jour, 8th Feb. and 26th July, 1890; Internat. Beiträge zur Wissensch. Med. Virchow Festschrift, 1, 1898.
23. MURRAY. Diseases of the Thyroid Gland, London, Lewis, 1900.
24. EDMUNDS. Jour. of Path., vols. iii, v, vi, and vii., 1896–1900. The Pathol. and Diseases of the Thyroid Gland. Edin. and London, 1901.
25. MUNK. Virchow's Archiv. cl., s. 271, 1897.
26. KISHI. Virchow's Archiv. clxxvi, s. 260, 1904.
27. HALPENNY and THOMPSON. Anat. Anz. xxxiv, band, 1909.
28. VASSALE and DONAGGIO. "Les Alterations de la Moella. éspiniére chez les chiens opérés d'extirpation des glandes parathyreoidiennes." Archives Ital. de Biol., tome xxvii, fasc. 1.
29. HERRING. Quart. Jour. of Physiol., vol. i, No. 3, 1908, p. 281.
30. ROGOWITSCH. "Die Veranderungen der Hypophyse nach entfernung der schilddruse," Xeigler's Beitrage Zur patholog. Anat., bd. iv, s. 453, 1889.
31. The Internal Secretions and the Principles of Medicine, Phil., 1903.
32. VASSALE and GENERALI. Archives Italiennes de Biologie, 1896, tome xxv, p. 464.
33. EDMUNDS. Jour. of Physiol., 1898–1899, vol. xxiii, p. 182.
34. FORSYTH. Jour. Anat. and Physiol., vol. xlii, 1908. Quart. Jour. of Med., vol. i, 1908; Trans. Path. Soc., Lond., vol. lviii, 1907.
35. THOMPSON, R. L. "A Study of the Parathyroid Glandules in Paralysis Agitans." Jour. Med. Res., vol. xv, No. 3.

FORCIBLE DILATATION OF THE KIDNEY PELVIS AS A MEANS OF DIAGNOSIS[1]

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EVERY diagnostician is familiar with the great difficulties at times encountered in differentiating obscure abdominal maladies. This is particularly true of diseases located in the right half of the abdomen, and any method that assists in clearing up these difficulties is worthy of our serious consideration.

It is perhaps unnecessary to recall the more common affections which we sometimes have to bear in mind in making a diagnosis, such as tubal or ovarian infections, tubal pregnancy, ovarian cyst with twisted pedicle, appendicitis, and intestinal affections, ureteral calculus and stenoses, kidney affections, and diseases of the biliary and pancreatic systems. I question whether we are puzzled more frequently by conditions in the lower right quadrant where the appendix so often gives rise to atypical symptoms, or in the upper right quadrant where the proximity of kidney, liver, gall-ducts, pancreas, pylorus, duodenum, and hepatic flexure naturally leads to conditions of uncertainty.

The method under discussion most frequently assists in differentiating diseases of the upper right quadrant, but it is often helpful in determining whether given symptoms belong to the upper or lower quadrant. Every surgeon with a wide experience is familiar with cases in which operation alone determined whether past attacks were due to appendicitis, cholecystitis, or floating kidney.

To avoid theorizing and speculating, processes so tempting in dealing with medical conditions hidden from view, I will select a few of the more striking cases to illustrate the value of this method of distension of the kidney pelvis in making a diagnosis. The method originated with Dr. Howard A. Kelly and it was my good fortune to have this occur during my first year of hospital service with him in 1898.

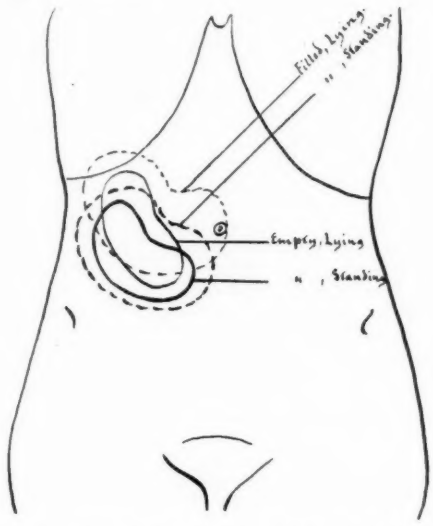

Fig. 1. Showing relative locations of the filled and empty kidney in case 1, with the patient in the dorsal and standing postures.

Case 1. *Floating right kidney with hydronephrosis and typical Dietl's crises.*

This case was seen with my colleague, Dr. Seegar of Baltimore. The drawing (Fig. 1), made during our examination, is more illuminating than a long description.

The patient, aged 22 years, had been suffering for one year with attacks of severe pain in the right side. These attacks, according to the patient's opinion, were not influenced by change of position, but during the attack she could not lie on her right side. They varied in duration from one to twenty-four hours, and after the attack the patient usually passed large quantities of light-colored urine. She was nauseated during the attack but never vomited. She does not know whether she had fever, and she has never noticed blood in the urine. She never called a physician until her last attack, when her family doctor found a large tender mass low in the right abdomen and called Dr. Seegar for a supposed appendix abscess.

On examination the patient showed the narrow feminine type of lower thorax with which one would expect to find movable kidney. The "kidney index"

[1] Read before the Chicago Medical Society, December, 1908.

of Becker and Lennhoff was 89.8. The right kidney was easily carried to any portion of the right abdomen as low as the pelvic brim, and it seemed rather large.

Fluid catheterized from the bladder contained a few leucocytes and epithelial cells and a trace of albumen. The bladder appeared normal. The right ureteral orifice was slightly red and puffy. The right kidney was easily catheterized and the patient was allowed to take the left lateral position. After waiting several minutes without getting a flow of urine through the catheter we began an injection of boric solution and several ounces were taken before the patient finally said an attack was coming on. We then clamped the rubber tubing leading from the end of the renal catheter and allowed the patient to turn to the dorsal position.

A large mass could be seen bulging the right flank and on palpation this was found to lie transversely and to reach from the bulged lateral wall to the umbilicus. Its long measure was 16 cm. and its transverse measure taken almost vertically was 9 cm. The distance from the costal border to the anterior superior spine of the ilium was 10 cm., and the upper end of the kidney mass lay beneath the costal border. Along the superior and anterior aspect of the kidney mass one could plainly palpate a broad notch containing a soft cystic area representing the dilated kidney pelvis.

On unclamping the catheter there was first a gush of air and the patient said, "I have no more pain now." 140 cc. of fluid was collected and more air escaped at intervals. At a later catheterization when care was taken to exclude the air, 172 cc. of fluid was collected after dilating to the point of discomfort.

The drawing shows the results on the kidney position, both when empty and full, of changing the patient from the dorsal to the standing position.

I assisted Dr. Seegar in the operation, which consisted in making the lumbar incision generally used for fixation of the kidney, in exposure and freeing of the perirenal capsule, and instituting drainage by means of two iodoform gauze rubber protective wicks carried from the skin surface through the kidney cortex into the pelvis of the kidney. I prefer this simple drainage operation for these cases of enlarged pelvis in floating kidney to the pyeloplication operation (Israel, Chirurgische Klinik der Nierenkrankheiten, p. 88, Berlin, 1901) largely because of its simplicity and because experience shows that we get the same end result of contraction of the pelvis.

CASE 2. *Floating kidney with attacks approximating Dietl's crises.*

Mrs. B. S., age 28, admitted to St. Agnes Hospital July 23, 1907. The patient became pregnant soon after her marriage, three years ago, and had a spontaneous miscarriage at three months with retention of the placenta. She was curetted and packed without anæsthesia, and she dates her ill feelings from the shock incident to this event. The patient now has much flatulence and indigestion and gets attacks in which she feels very nervous, has cold hands and feet, loose bowels, and has a shaking chill and is very faint and prostrated afterward. She has no pain with these attacks but has a queer feeling in the back of her head at the beginning of her nervous attacks. In the past two months she has had attacks every day or two and is afraid to eat because of the indigestion, flatulency, and loose bowels. She has lost twenty pounds in two months, and now weighs but ninety-four pounds. On taking the detailed history I was led to think of the possibility of gall-stones, appendicitis, and of neurasthenia.

Both kidneys were easily palpated and the right was movable to the third degree. On injecting the pelvis of the right kidney without the patient being aware of what was being done she suddenly exclaimed, "Oh, that queer feeling in the back of my head; what are you doing, doctor?" But two drams of fluid returned, showing a normal sized pelvis. The injection was repeated with the same result, but on forcing the injection slightly pain was caused in the right kidney region. The patient was kept in bed for one week, and after being fitted with an abdominal binder she remained in the hospital another week gaining rapidly. She was then allowed to go North for a visit and after five weeks she had gained twelve pounds. She has since given birth to a child and is now in fairly good health.

CASE 3. *Hydropyonephrosis due to stricture of ureter.*

Mrs. S. E. D., age 52, admitted to Church Home, May 7, 1907.

This patient had been complaining of attacks of pain in the left side for thirty-four years. At first these pains were not severe; they were located in the left umbilical region and came on only when driving or getting a sudden jar. At first they were very irregular, from one week to six months apart. After a few years she began to have chills with some of these attacks. At times she had to have medicine and then she often vomited. Lately the attacks have been more frequent and more severe. They come from seven to ten days apart and last from one to twelve hours. She sometimes gets relief by voiding but she never notices an increase in the urine unless she has been drinking more freely. She has never noticed any blood in the urine but she thinks there is pus after the attacks. She has lost fourteen pounds in weight in the past three months.

Examination. See Fig. 2. The patient is a thin woman and a large mass can easily be seen and felt in the left anterior flank region, its lower end reaching a few centimeters below the transumbilical line. This mass is fairly movable and has a semicystic feel.

Cystoscopy. The urine catheterized from the bladder was acid, turbid, sp. gr. 1015, and contained a large number of pus and a few epithelial cells. Urine gathered directly from the right ureteral orifice through the speculum showed no abnormal elements. The left kidney was catheterized and the urine after settling a few minutes had half its volume taken up with a flocculent white deposit. The sp. gr. was 1010 and the reaction slightly alkaline. The microscope showed considerable pus and mucin, and few epithelial cells. No blood, no casts, and no bacteria were seen in the fresh specimen. Unfortunately a culture was not taken.

On injecting the pelvis of the kidney 240 cc. were

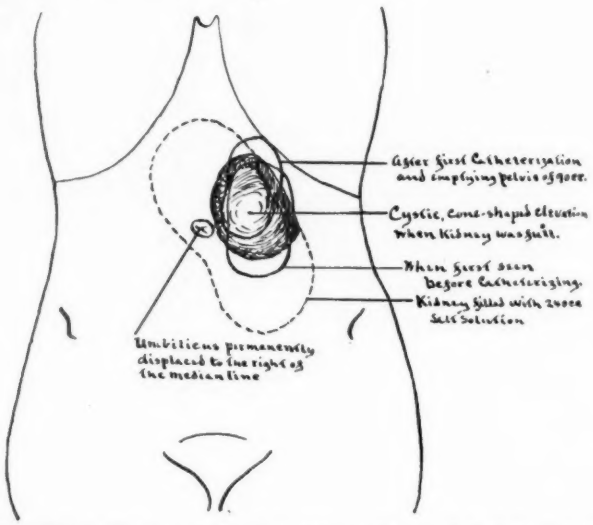
After first Catheterization and emptying pelvis of pus.
Cystic, cone-shaped elevation when kidney was full.
When first seen before Catheterizing.
Kidney filled with 2000 c.c. Salt Solution
Umbilicus permanently displaced to the right of the median line

Fig. 2. Showing, in case 3, the relative location and size of the kidney when partially full, and when first seen; when empty, and when fully dilated.

introduced before the patient complained of any discomfort. The kidney when thus injected left its position in the left flank and its upper pole reached to the right edge of the right rectus muscle in the epigastric region while the lower pole extended below the level of the anterior superior spine of the ilium and lay under the left rectus muscle. The middle third of this mass was occupied by a cone-shaped elevation presenting just to the left of and above the umbilicus and having a cystic feel.

At operation the kidney was delivered through the usual incision and it was found to be so distended as to present only a thin shell of kidney substance. It was therefore removed together with the upper third of the ureter.

On catheterizing the kidney a wax-tipped catheter was repeatedly obstructed about 2 cm. from the vesico-ureteral orifice, but no scratch marks were obtained and it is probable that the condition of the kidney originated from some form of ureter stricture.

A letter fourteen weeks after the operation reported better health than for years and a gain in weight of eighteen pounds.

CASE 4. *Stone in ureter. Appendicitis symptoms. Injection shows hydronephrosis.*

Miss J. A., age 25. For the past three years the patient has had attacks of pain in the posterior right flank region extending forward to the anterior flank region. These attacks have been irregular, occurring at times as often as two or three in a week. At times she would have none for two or three months. During the attack she feels swollen, and says that her mother can feel a tumor mass. Between the attacks when she stands she has a pulling misery as if something on the right side were too short. She has the same sensation when she lies on the left side. She always has to sleep on the right side. She has been told by one physician that she was suffering from stone in the kidney, and by another that these were appendicitis attacks.

On examination the patient is seen to be a small woman with costal margins very low reaching to the level of the umbilicus. This makes one think of a high kidney index and floating kidneys. Although the kidney index is 89, neither kidney can be palpated, probably because of the very low costal margins.

Cystoscopy. The bladder is normal. Both ureteral orifices are normal although there is slight reddening of the mucous membrane about the right orifice. There is no pouting or eversion of the mucous membrane at the orifice, and nothing except the slight hyperæmia to indicate that there is a diseased condition above. A 2 mm. catheter is prepared with a wax tip and this enters the ureter only two to three cm., where it is obstructed. On withdrawal there is seen to be considerable bleeding from the ureter and the wax is entirely gouged off on one side in a groove with rather precipitous edges. A 1¾ mm. catheter is prepared with a small wax tip and this goes by the obstruction with great difficulty. The stilette had to be left in the catheter to stiffen it so that it could be forced past the obstruction. On withdrawal the catheter is tightly grasped by some obstruction until it almost leaves the lower end of the ureter. The wax is gouged off on one side like the first wax tip and on the opposite side there is a deep wide scratched area. It is probable that the catheter took a half turn in its passage to and from the kidney. Up the side of the catheter the gum

elastic material is deeply scratched by parallel lines over a width of 1 mm.

While the catheter was in the kidney the kidney pelvis was injected with about 40 cc. of salt solution before the patient complained of pain. Only 35 cc. returned from the kidney in a steady flow, and it is probable that a few cc. remained in the ureter.

A week later I repeated the catheterization, this time covering a 2 mm. catheter at a point about 6 cm. from its tip with a spindle shaped mass of wax to act as a dilator. An X-ray taken in the meantime had demonstrated a very small stone in the bladder region, and I hoped by the use of a little dilatation to get the stone to pass. About one quarter of the wax spindle was gouged away. I deferred making an injection of oil until another visit.

Forty-eight hours after the dilatation the patient had one of her worst attacks. This was partially controlled by morphia ¼ grain by mouth.

About three weeks later the patient was operated on by another surgeon, who removed the appendix, and took a small stone from the lower end of the right ureter.

Four months later the patient came to me complaining of pain in the right side over the cæcal region. From its character I thought this pain might be due to intestinal adhesions. The operation must have been a severe one for the patient was said to have been in the operating room five hours.

A catheterized specimen of urine showed some pus and epithelial cells, and a culture taken from the kidney yielded colon bacillus growth, but the urine looked almost clear and it contained no albumen. A wax-tipped catheter of 2 mm. diameter passed to the kidney without obstruction and on withdrawal there were no scratch marks.

Forced injection of the kidney pelvis caused a sharp pain in the lumbar region which the patient said was like her previous attacks and not like the pain now troubling her, which was less severe, of a different character, and located in the anterior flank region.

After injection to the point of pain, 15 cc. of urine returned, showing the pelvis to still hold twice a normal amount as contrasted with its former capacity of 40 cc.

CASE 5. *Stone in the ureter. Attacks like Dietl's crises. Infected hydronephrosis.*

Mrs. E. L., age 37. Church Home, June 20, 1906.

A case, very similar to the last, from whom I removed a spindle-shaped stone about 14 mm. long from the lower end of the right ureter about 4 cm. above the bladder. The kidney pelvis and ureter held 45 cc. on injection to discomfort. She had had attacks of severe renal colic for 22 years, these attacks often awakening her suddenly at night, when she would sometimes spring out of bed before becoming thoroughly awake. Her attacks came in sharp, cutting paroxysms of pain beginning in the right flank and stopping in the right groin. She often vomited. While I was injecting the pelvis of the kidney the patient suddenly exclaimed: "For God's sake, doctor, stop, I am going to have one of my attacks"; and she immediately attempted to leave the table, and showed every evidence of mortal terror.

The urine gathered from the right kidney contained considerable pus and yielded a pure culture of colon bacillus. The stone was accurately located by the waxed catheter low in the ureter, and X-ray confirmed the diagnosis.

CASE 6. *Gall-stone attacks with an immense gall-bladder mistaken until injection of the kidney pelvis, for a misplaced kidney.*

Mrs. R. O. E., age 29, admitted to Frederick City Hospital, August 12, 1908. The patient has had a great deal of pain in the abdomen since she was sixteen years of age. Since the birth of her first child nine years ago, she has worked very hard and has had much cramp colic, dyspepsia, and heart palpitation. For the past nine weeks she has noticed a mass in the right flank region. Three weeks ago while shopping she was taken suddenly with faintness and nausea, and pain and tenderness in the upper right quadrant of the abdomen. She went immediately to the office of her family physician and he found a large, movable, tender mass in the upper right quadrant and considered the patient's attack to be one of kidney colic.

I examined the patient first in the dorsal position and found the mass in the right side which I considered a movable kidney, although I was not particularly careful in the examination. This mass on being pushed back toward the kidney position swung outward and upward under the ribs instead of going vertically upwards. This was suggestive of gall-bladder.

On injecting the right kidney pelvis the patient was very definite in locating the pain thus caused more in her back and flank, while she stated that her former pains were located across the upper quadrant and more in front.

Operation showed an immense gall-bladder with distended thin walls. The gall-bladder and cystic duct together formed a mass the size and shape of a small crook-neck squash. The gall-bladder measured six inches in length and three inches in diameter, and the cystic duct was four inches long and three-fourths of an inch in diameter. Incision into the gall-bladder evacuated 400 cc. of opalescent, clear fluid and between 200 and 300 small stones. A separate incision had to be made in the lower end of the cystic duct to deliver a large impacted stone mass which was found to be made up of multiple agglutinated fine stones.

CASE 7. *Gall-stones. Immense hydrops of gall-bladder. Kidney symptoms.*

Mrs. L. L., age 39, admitted to the Church Home, September 29, 1908. This patient presented a mass very similar to that described in the last case. The resident in the hospital, a man with six years of hospital experience, felt certain that the mass in the right flank was the right kidney. I could not feel the right kidney independent of this mass, but from its anterior position and the ease with which it could be displaced far toward the left side I considered the mass a gall-bladder.

On forcible injection of the right kidney pelvis the patient said that the pain was of the same character and that it was located to the right of the umbilicus

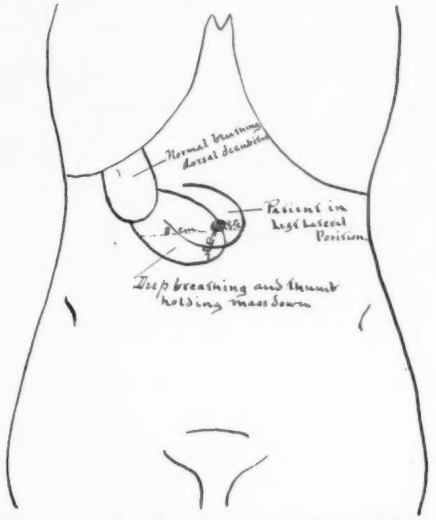

Fig. 3. Showing different positions of the gall-bladder in case 8.

just as the pain before suffered. The pelvis held three drams of solution.

At operation the gall-bladder and cystic duct were very similar in size and shape to those described for the last case. One large stone blocked the lower end of the cystic duct, and the lower end of the gall-bladder projected as a spur back into the foramen of Winslow. The right kidney was unusually high in the paravertebral niche and it had apparently been held in this high position by the backward projection of the gall-bladder. This is a possible explanation for the increase in size of the kidney pelvis and for the pain phenomena, since a portion of her pain may have been due to kidney colic from pressure on the ureter by the gall-bladder.

CASE 8. *Cholecystlithiasis. Hydrops of gall-bladder simulating kidney mass.*

Mrs. A. N., age 42. This patient was seen in October, 1907, at St. Agnes Hospital in consultation with Dr. Seegar. In May, 1907, she had suffered a severe attack of abdominal symptoms which Dr. Pound, her family physician, thought due to gall-stones. During the intervening five months she had suffered more or less pain in the right upper quadrant but she had not had another attack of colic.

At examination (Fig. 3) an elongate mass was found in the upper right quadrant, which on quiet breathing, reached almost to the transumbilical line. On deep breathing the mass could be grasped and pushed downward so that the lower pole reached 5.5 cm. below the umbilicus. With the patient lying in Sims' left lateral position the lower pole of the mass reached 4.5 cm. to the left of the umbilicus. From any position the mass could easily be pushed back to the kidney space beneath the costal margin. It was solid feeling and non-sensitive.

While the mass lay near the anterior abdominal wall and had a pendulum motion, thus suggesting gall-bladder, its ease of replacement to the kidney region and the fact that a right kidney could not be palpated separate from the mass made us think of the mass as of kidney origin, and its density suggested tumor of the kidney. Forcible injection of the kidney pelvis to the point of pain showed the pelvis to hold five drams or two and a half times the normal amount. The patient was positive, however, in locating this pain far back in the posterior flank (kidney) region, and said that her attack of pain in May had been more in the anterior abdominal region and reflected over the abdomen.

At operation Dr. Seegar made a compromise incision through which he might easily operate on the kidney or the gall-bladder. He found the tumor to be an immense hydrops of the gall-bladder caused by an impacted stone in the cystic duct. He was compelled to make a second incision to more easily deal with the cystic duct stone.

CASE 9. *Movable kidney of second degree, with attacks mistaken for appendicitis.*

Miss N. B. M., age 19. Cambridge Hospital, September 22, 1907. The patient has had attacks of pain in the right side since a child. Her mother says that as a child four or five years old she used to have attacks of pain which caused her to bend double and to get white and cold and stiff.

The patient was operated upon three years before I saw her for supposed chronic appendicitis. After the operation even while in the hospital as soon as she took the erect posture, she has the old pain in the appendix region and within six weeks after the operation she had a bad attack of her so-called "cramp colic". She has had repeated attacks since, in which the pain would course down from the right kidney region along the ureter region and into the anterior thigh. She thinks that since the operation the pains have been more pronounced in the back and down the thigh.

During the past year there was no severe attack until five days ago when the patient had a feeling in the abdomen as if suffocating and then an awful "kink" and pain in the appendix region which prevented her straightening up. The cramp-like pains extended down to the heel. She has had no bladder disturbance at any time. There has been but little soreness. She is more comfortable when dressed, the clothing seeming to support her. She sleeps on the right side or back, and if she turns to the left side she feels something come out and drag.

Examination. The right kidney can be grasped and held below the costal margin but it does not impress one as being very movable. There is no special tenderness in the appendix region although the history makes one think of the possibility of adhesions being the cause of the present condition. A wax-tipped bougie was passed to the kidney. The wax tip returned negative. A forced injection of sterile salt solution caused an exact reproduction of her severe attacks and six drams returned showing the pelvis to be three times the normal size. An abdominal binder gave the patient complete relief and she gained considerably in weight and is now attending college and enjoying good health.

CASE 10. *Floating right kidney, third degree. Chronic recurrent appendicitis and ureter obstruction, probably influencing the kidney symptoms.*

Miss L. H., age 30. Union Protestant Infirmary, July, 1907. For the past three years the patient has been suffering with her right side. She has been ill most of the time. At rare intervals she feels perfectly well and then suddenly gets nauseated and sometimes vomits and has a severe, sharp pain in the lower right abdomen and extending down the right leg as far as the knee. She has a dull, sickening feeling in the lower right quadrant most of the time. At times when she sits down she feels something pressing upward in the right side of the abdomen. She works in a dry-goods store and has much standing and much heavy lifting, and thinks this exaggerates her trouble.

About two months ago she had what was called congestion of the womb, which came on suddenly just after menstruation. She had terrible pains in the pelvis and was ill for a week. Since then she has had considerable leucorrhœa.

She sleeps on her right side as this seems to ease the pain.

Dr. Finney saw the patient one year ago and prescribed an abdominal binder, which helped only temporarily. Dr. Finney was kind enough to ask me to take charge of the patient and investigate the kidney condition.

A specimen of urine catheterized from the bladder was normal. There was no evidence of gonorrhœa. The right kidney was fairly movable and rather large and tender and occupied a position near the appendix region. On passing a renal catheter it was obstructed at a point about 6 cm. beyond the bladder, and on withdrawal the tip showed a bent condition. A few days later a wax-tipped catheter was passed and met the obstruction at about the same point, but the catheter passed to the kidney without scratching the wax tip. Injection of the kidney pelvis caused severe cramp-like pains which the patient located higher than the severe attack of pain she had two months ago during the attack of so-called womb trouble. But she says that the attack corresponds in character and location to the attacks of the past three years. The kidney pelvis held two drams.

I considered this a patient suffering both from chronic appendicitis and movable kidney symptoms. At operation a small myoma was enucelated from the uterus, the appendix was found to be bound by many adhesions to the pelvic brim over the ureter region. The appendix was doubled on itself and considerably inflamed. After closure of the abdominal wound the kidney was fixed through the usual lumbar incision.

CASE 11. *Chronic appendicitis. Appendix adherent over ureter. Injection test seemed to involve kidney as cause of former pains.*

Mrs. E. K., age 37. Frederick City Hospital, June 18, 1908. The patient complains of pain in the right side. Before her marriage seven years ago she was always healthy and stout. Two years ago, while two months' pregnant, she slipped on the ice and had a bad strain in the right side and a miscarriage followed. She has had trouble in the right side ever since. The pain is mostly in the flank region just above the crest of the ilium. Last spring she had her worst attack of pain in the right side, the pain lasting for three or four weeks and causing her to remain in bed for one-half day. She now has the increased pigmentation over the right flank where the skin was blistered by hot applications at that time.

I saw this patient in consultation with Dr. Johnson one year ago, her symptoms then being ascribed by Dr. Johnson to a movable kidney. I decided that she was probably a subject of neurasthenia and we determined on forced feeding to favor replacement of the kidney by an increase of fat. This treatment failed and the patient has lost weight and has fallen into a nervous and complaining condition.

On her second examination in June, 1908, the right kidney was not very movable, but it could be held below the costal margin. Catheterization and injection with salt solution caused pain of the same character and in the same locality as that formerly suffered. This was above the crest of the ilium and far back in the flank. In spite of this test the history sounded so much like a chronic appendix that I decided first to explore the appendix, and if definite trouble was not found, to then fix the kidney. The appendix was found to be long and to be densely fixed by its tip at a point 4 or 5 cm. below the pelvic brim and over the ureter.

I decided that the pain, which had been located principally above the crest of the ilium, might be explained by either of two conditions,— either the fixation of the inflamed appendix over the sacral plexus might cause reflected pain, or the fixation of the appendix over the ureter might have caused swelling of this organ, with slight distension of the kidney and pain reflected to the lower flank as it was from my forced salt solution injection. I therefore removed the appendix and neglected the kidney and the patient had a rapid return of her former weight and good health.

You will readily observe in the account of these cases that this method is not put forth as one of universal and never-failing application. In three instances here recorded, cases 7, 8, and 11, as well as in several not here reported, the results of the examination have not been trusted implicitly. Other circumstances of the case have been weighed against the results of the kidney injection, and the diagnosis made in conformity with what seemed the best line of evidence.

In most instances of going flatly against the indications given by the kidney injection we have been wrong, or we have found conditions indicating that both the kidney and some other organ (usually the gall-bladder or appendix) were concerned in the patient's ill health. For instance, in case 8 the patient was clear

in her statement that the kidney colic caused by the injection was in the posterior flank region, while the attack of pain previously suffered was in the anterior abdominal region. In spite of this Dr. Seegar and I both favored a diagnosis of floating kidney or tumor of the kidney and he made a compromise incision, between the kidney and gall-bladder, only to find it necessary to make a second incision for the removal of a large impacted cystic duct stone. In case 7 the identification by the patient of the pain caused by the injection with her former misery, and the slight increase in the size of the kidney pelvis, both pointed to the movable mass as of kidney origin. Other factors led me to properly diagnose gall-bladder, but the operation revealed the right kidney being held high above its usual situation by the large posterior protrusion of the gall-bladder, and this probably pressed upon the ureter and involved the kidney in the patient's symptoms.

It is of particular interest to note that in cases 6, 7, and 8, each presenting a large cystic gall-bladder due to impacted cystic duct stone, the kidney had been displaced upwards, and in two of the cases the injection showed the kidney pelvis to be slightly enlarged.

In case 11 the injection caused pains of the same character and location as those complained of by the patient; but in view of her past history of trauma, miscarriage, and exacerbations of pain I explored the appendix region and found this organ densely bound by its tip to the posterior wall of the pelvis. You are perhaps familiar with the paper I published recently in the Journal of the American Medical Association (vol. l, 1908) concerning acute pyelitis due to acute appendicitis. The first of the four cases there reported seemed to find its explanation in the densely adherent appendix lying over the ureter, the recurring attacks of appendicitis probably causing ureteritis and pyelitis.

The method is extremely valuable in studying kidney and ureter conditions per se. The passage of a waxed catheter discovers to a certainty the presence and location of a stone in the ureter. In cases of multiple ureter stones the position of the lowest one only can be determined. Stone in the kidney may be missed by the wax-tipped catheter, but an unusual amount of blood after dilating the pelvis of the kidney is suggestive of the presence of a stone. We are able to study the degree of distension caused by stone in the ureter. In many of these cases the attacks of pain are undoubtedly due to the hydronephrosis rather than to activity of the stone.

The location and nature of ureter strictures can be studied while catheterizing for the kidney injection. Many temporary obstructions are met in passing the catheter which are probably due to peristalsis in the ureter. Such obstructions are easily overcome after a short pause in the manipulation. Other obstructions are met repeatedly in the same locality in a given case and still there may be no other evidence of stricture. These are most often found in the lower half of the ureter and they are probably due to appendix or pelvic inflammations having displaced local areas of the ureter.

Cultures taken during the examination reveal the presence and character of an infection.

We can measure the degree of hydro- or pyonephrosis and by collecting the urines from the two sides we can make the urea or the freezing test and know before the operation the working value of each kidney, and have a provisional idea as to whether the operation should be a nephrectomy or a simple drainage.

The greatest utility of the method as regards kidney conditions is in the study of movable kidney with its allied phenomena of torsions, Dietl's crises, hydronephrosis, etc. The kidney colic known as Dietl's crisis occurs most often in kidneys with dilated pelvis, and is probably due in most cases to a sagging of the kidney without a corresponding descensus of the upper end of the ureter, thus causing a kink and an overfilling of the pelvis. This fixation of the upper ureter and consequent angulation on descent of the kidney is due in some cases to supernumerary vessels. and in some to the fixation of the periureteral fascia.

In those cases of Dietl's crisis without permanent enlargement of the pelvis it may be that the same mechanical forces are at work causing a temporary overfilling of the pelvis, or such cases might arise from twist of the kidney pedicle and vascular engorgement.

The polyuria sometimes following Dietl's crisis can scarcely be ascribed to the emptying of the dilated kidney pelvis as was formerly thought, for it is rare to find a pelvis holding more than 250 cc., or half the content of a normal bladder. The polyuria, which often lasts for hours, is probably due to circulatory changes following the ischemia in case of overfull pelvis, or following the passive congestion in case of twist of the kidney pedicle.

In my private records ninety-two cases have had signs and symptoms to attract the attention to a movable or floating kidney. Of these, twenty-eight were injected for purposes of diagnosis and ten of these showed pelves holding 15 cc. or more, that is, they showed a capacity twice the usual size or greater. Only three of these had suffered with distinct Dietl's crises. Another case with Dietl's crises had a capacity of 11 cc., or one-half greater than normal. Of the seventeen cases injected whose pelves were normal, or varied only slightly, none had Dietl's crises.

Of sixty-four cases not injected for diagnosis three had attacks like Dietl's crises of a mild grade.

In some of the cases here reported and in many similar ones this method has been of the utmost diagnostic value in helping to decide which of the abdominal organs was diseased. It is of no small importance to the surgeon and particularly to the patient if by this method we can determine that an extremely movable kidney is causing only a portion of the symptoms. In a case recently operated on I tried for two years with indifferent success to make the patient comfortable by abdominal binder and medical treatment at the hands of others. Finally on trying a six weeks' rest in the hospital we found that her occasional attacks of increased discomfort in the right side were accompanied by a slight rise of temperature, coated tongue, loss of appetite, and soreness in the appendix region. On injecting the kidney pelvis with moderate distension the patient said that this imitated the pain in the back and flank, but that her more pronounced discomfort was distinct from this and located just within the anterior superior spine region. The operation of kidney fixation, which had long been thought advisable, was supplemented by removal of a distinctly diseased appendix, and it is certain that the kidney fixation alone would have fallen far short of permanent relief.

In my experience not a few patients suffer from symptoms of movable kidney, which have arisen at a comparatively recent date, and subsequent to a history of appendicitis, gall-stones, or pelvic disease. The correction of the original disease results in an increase in fat and the general well being of the patient, and the kidney takes a better position and eventually ceases to cause trouble. An abdominal binder or special corset is an important factor in the post-operative care of such patients.

Method. This diagnostic method is comparatively simple when applied in women. I use the simple tubular cystoscope of Kelly and if the patient is in fair physical condition she takes the knee-breast position during the cystoscopy and renal catheterization. If for any reason this is difficult or impossible I use Sims' posture or the dorsal elevated pelvis position. As soon as the kidney is catheterized the patient is allowed to take the dorsal position or the lateral position with the catheterized side uppermost. It is best to use a large catheter to prevent any back flow in making the injection; and, in cases of hydronephrosis, to prevent leakage while making observations with the pelvis full. A 2 to 2.5 millimeter catheter is satisfactory. The catheter is usually tipped with wax and if a ureteral stone is suspected the wax is applied in rings down the catheter, or the entire surface is covered by sweeping the catheter through a watchglass of hot wax. In this way one can locate a ureter stone accurately.

In making a forced injection of the kidney pelvis one can use a small rubber ear syringe holding one ounce of fluid, in which case the renal catheter should have a rubber tubing shoulder over its outer end, and a metal or glass tubing is used for connecton between the syringe and the rubber shoulder. A more convenient injection apparatus is a glass aspirating syringe with two-way stop cock, short rubber tubing for aspirating the fluid, and blunt needle for injecting the fluid, directly into the renal catheter(see Fig. 4). Sterile water, boracic acid solution, or preferably normal salt solution, is used for the injection, and if for

any reason one anticipates possible leakage around the renal catheter the solution is strongly colored with methylene blue and a glass catheter is left in the bladder during the injection. In making the injection one should distend the kidney slowly and ask the patient to notify the operator when she feels any discomfort. By making a sudden forced injection a severe colic can be induced even in a normal kidney and the pain may be so severe that the patient is unfitted to make comparisons with past attacks of pain.

Fig. 4.

Like most every other diagnostic method this one is subject to misinterpretation. One must often control seeming results by the personal equation of the patient. The perturbation incident to any examination may amount in this manipulation to a degree of fright which profoundly influences the patient's judgment. In rare cases there is caused an unusual amount of pain which lasts several hours, but with care the method is followed day after day in dispensary and private office practice without unpleasant consequences. If the pain or nervousness seem excessive I generally insert a one or two grain opium suppository before the patient leaves the table, and she is advised to rest for a half-hour before starting home.

Treatment. Strictly speaking, the subject of treatment of movable kidney conditions carries us beyond the province of this paper. It is so vitally related to the questions of diagnosis that it will almost inevitably arise in the discussion and for that reason I shall consider the matter briefly at least. In my series of ninety-two cases thirty-three had a fixation of the kidney. I consider such a high percentage of operations absolutely unjustifiable in the average run of cases and wish to state that my attitude toward kidney fixation is a conservative one. It must be remembered that a certain percentage of these cases were sent to me for operation after other means of treatment had been exhausted. In seven of the operated cases I tried abdominal binder or special corset until these were found a failure. In only nine of the cases was operation done for the kidney alone. In other words, in twenty-four of the cases the kidney fixation was done in association with other seemingly necessary operations. Had it not been for the other operations necessitating a general anæsthetic it is probable that the abdominal supporter would have been found helpful, as it has been in many of the unoperated cases.

In thirty-five of the ninety-two cases, a special binder or corset was fitted, and the results have been such that I recommended this conservative treatment in practically all cases suffering from movable kidney. The exceptions in which I advise operation without trying conservatism are those cases in which injection shows a greatly dilated pelvis holding one ounce or more. In such cases a special corset or binder may give seemingly good results for a time but the patient is almost certain to return for operation. Another class with symptoms referable to movable kidney for which I advise operation includes those patients who need an operation for some other malady and in which the kidney operation can be combined without too much risk.

It is because of these combined operations in the majority of cases that one cannot say just how much the fixation of the kidney does for the patient. We have probably all had the experience of removing a chronic appendix or of doing necessary pelvic operations without fixing a movable, symptom-producing kidney, and seeing the patient regain tissue tone and fat and cease complaining of these kidney symptoms.

For similar reasons one cannot give statistical results from a series of kidney cases fitted with an abdominal support. The support is often fitted after an operation on other organs, or a pessary is simultaneously introduced to correct a malposition of the pelvic organs, or some other line of treatment is instituted at the same time, making it difficult to say just how much of the patient's improvement can be ascribed to the abdominal support.

REMARKS ON THE OPERATIVE TREATMENT OF TUMORS OF THE HYPOPHYSIS[1]

With the Report of Two Cases Operated on by an Oro-Nasal Method

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IN reviewing the literature on the operative treatment of tumors of the hypophysis, we find that many of the procedures proposed are based only on experience gained in the deadhouse and not upon operations performed on the living. Most of these proposed methods have yet to be tried in the operating room before their merits and their defects can be properly estimated.

Of the operations proposed, two principal routes have been chosen to reach the hypophysis. First, the intracranial; second, the extracranial or transphenoidal.

Through the former the hypophysis may be reached either by way of the anterior or the middle cranial fossæ. The major part of the operation may be accomplished by working outside of the dura, extradural, or the dura may be opened in the beginning and the work done entirely within its cavity.

The possibility of reaching the hypophysis through the middle cranial fossa was first proposed by Caton and Paul (1), but was not carried out by them. Horsley is generally quoted as following this route.

In reviewing the literature, I was unable to find any case reported by Horsley. From a personal communication from him I learn that he has not published any of the cases operated on by him, therefore, I am unable to verify the statement generally made by writers on this subject, that he operates by way of the middle fossa and reaches the hypophysis by opening the dura and elevating the temporosphenoidal lobe from the base of the skull.

Stumme(2) quotes a personal communication from Professor Petrien, in which he credits Dahlgren with an operation conducted through the middle fossa. In this the dura was opened and the hypophysis reached by retracting the brain. Nothing is said of the details of the operation or of the result.

Krause (3) suggested what appears to be the most rational intracranial method of reaching the hypophysis. He proposed to open the cranial cavity by an osteoplastic resection of the frontal bone and to proceed, extradurally, through the anterior cranial fossa until the lesser wing of the sphenoid is reached, and then to open the dura and remove the tumor by means of a small hook-shaped knife devised for that purpose. Krause, from his experience gained only by operations on the cadaver, believed that by following this extradural route all or most of the obstacles which other operators had encountered would be eliminated.

Borchard(4) attempted to remove a tumor of the hypophysis by the Krause method, and was forced to abandon it because of the hæmorrhage. Later he operated successfully on the same patient by the transphenoidal route, as practiced by Schloffer.

Kiliani (5), in discussing tumors of the chiasm, suggests an operation which is similar to that of Krause, excepting that the dura is opened immediately after entering the cranial cavity. The longitudinal sinus is ligated, the frontal lobe lifted from the base of the skull, and the tumor attacked above the chiasm and the transverse sinus, by means of a sharp spoon.

In a recent number of the Wiener Klinische Wochenschrift, Silbermark (6) suggests a temporal intracranial method similar to that employed by Paulesco and Cushing (7), in their experimental work on dogs. This consists in a bilateral craniectomy, the counter opening being made to permit of the temporal lobe being dislocated without the risk of serious compression. The operation proposed by

[1] Read before the American Surgical Association, Washington, May, 1910.

Silbermark and by him performed on the cadaver has never been tried on the living.

The relative merit of the intracranial method as compared to the transphenoidal is still a matter for discussion. Most operators have chosen the latter. Up to the present time no one has successfully removed a tumor of the hypophysis through the anterior intracranial route.

The temporal route, by way of the middle fossa, has been followed by Dahlgren and Horsley (8).

The anatomical structures that come in relation to the operative field are many and of great importance. Injury to the large venous sinuses, if not a serious menace to the life of the patient, would at least delay the operation and would probably preclude the possibility of completing the operation in one sitting. In the intracranial operation, aside from the danger of injury to the important blood-vessels and nerves, retraction of the brain sufficient to expose the hypophysis is likely to be followed by softening or necrosis, as a result of the trauma and interference with its blood supply.

The lateral intracranial operation has been employed by Cushing in over one hundred experiments on dogs. While by this method the canine hypophysis is readily exposed, Cushing is of the opinion that it is not practicable in operations on the human, excepting possibly in benign cysts of the gland that project into the infundibular region. In cases where the growth occupies the sella turcica, it would be impossible to reach it excepting by the transphenoidal route.

The first to suggest the transphenoidal extracranial operation was Koenig (9), in 1898. His procedure was identical with the oro-nasal operation practiced by Friedman and Maas on animals, and by Gussenbauer for the removal of naso-pharyngeal growth. It consists in separating the muco-periosteal covering from the palatal process of the superior maxilla, after which the process is chiseled away and the superior maxilla split and the lateral halves retracted. The septum and vomer are removed with the other structures of the nose that may obscure the view of the operator. The sphenoid cells are opened and their posterior walls chiseled away, bringing into view the hypophysis.

A similar operation has been proposed by Loewe (10). The nose is split by means of a long incision to one side of the median line, the maxillæ are separated, the inner walls of the maxillary sinus are removed, from the canine fossa upwards, and the septum divided back to the vomer, which is removed and the sinuses entered by chiseling away their anterior walls. The sella is reached through the sphenoid cells.

It will be seen that the bucco-nasal route of Koenig and the operation of Loewe are in reality quite similar in the essential features to the later inferior nasal operations. The strongest objections urged against both of these procedures is that they are unnecessarily severe and disfiguring. They have the advantage of offering the most direct route to the sphenoid cells with least risk of entering the cranial cavity anterior to the sella.

The first to suggest the superior nasal route was Giordano (11). This method, as practiced by him on the cadaver, consists in an osteoplastic resection of the anterior wall of the frontal sinuses and the nose. These structures are turned down and the ethmoid cells opened and their walls removed. The cells of the sphenoid are then opened and the hypophysis reached through an opening in the anterior wall of the sella.

The operation of Giordano has been followed, though slightly modified, at times by all who have chosen the superior nasal route in operating on the hypophysis.

Schloffer (12) in 1907, successfully removed a tumor of the hypophysis by a similar method. The steps of his operation were as follows:

An incision above and to the left of the nose; the whole nose turned down and to the right; excision of all of the turbinate bodies, septum, inner wall of the orbit nearly to the optic foramen; removal of the inner wall of the left maxillary sinus and part of the left nasal process of the superior maxilla; opening of the ethmoid cells and extirpation of their walls; opening of the sphenoidal cells through which the sella is broken down. The tumor was recognized as a pulsating mass, projecting through the opening in the sphenoid, and was curetted away with a sharp spoon. The pa-

tient survived two and one-half months. Autopsy showed that only about one-sixth of the growth remained.

The operation proposed by Moskowiez and Tandler (13) differs slightly from that practiced by Schloffer. The inner wall of the orbit and that of the antrum are not disturbed. They also recommend that the operation be performed in two steps. The first takes the operator to the posterior wall of the sphenoid sinus, which is permitted to remain intact. A pedunculated flap of skin is then turned down from the forehead, so that the end comes to lie on the sinus wall. At the second step the posterior wall of the sinus is broken down, and the end of the skin flap pressed into the cavity remaining after opening the sella and removing the tumor. This is held in place by a tampon. The skin flap is so placed, in order to lessen the dangers of infection. This step seems to be of questionable value. It would appear to enhance rather than minimize the risk of infection of the meninges.

v. Eiselsberg (14) in the three cases published followed the superior nasal route. The incision described differs slightly from that employed by Schloffer, in that a vertical incision along the median line of the forehead meets a curved incision above the root of the nose. The nose, with the anterior wall of the frontal sinus, are reflected downwards and to the right. The septum is divided and the superior turbinates removed. The vomer is removed piece by piece up to its root. After lifting the periosteum from the anterior wall of the sphenoid, the sinuses are opened by chiseling into them. The tumor is then exposed by removing their posterior walls.

Borchard, in 1908, exhibited a patient at the German Surgical Congress in Berlin, from whom he had removed a portion of a tumor of the hypophysis. He first attempted its removal through a frontal intracranial operation. This failed on account of profuse hæmorrhage making it impossible to locate the hypophysis. Later, through the superior nasal route, as practiced by Schloffer, he succeeded in exposing the tumor and removing a part of it.

Stumme, in 1908, describes an operation performed by Hochenegg upon a patient suffering from acromegaly, with other symptoms of pituitary tumor. The technique followed was similar to that of v. Eiselsberg. The anæsthetic employed was Billroth's mixture, preliminary to the administration of which the post-nares were tamponed with gauze. After turning down the nose, an osteoplastic flap containing the anterior walls of the frontal sinuses was reflected upwards. The septum and the entire contents of the nose, including all of the turbinates, were removed. The inner wall of the antrum and orbit were left intact. The sphenoidal sinuses were opened by means of a chisel and later their posterior walls, exposing the tumor, which was removed by a spoon-shaped instrument. The cavity was packed with gauze and the nose replaced and sutured.

Cushing has operated on three cases. In the first, an acromegalic, employed the supranasal operation, similar in detail to that of Hochenegg, excepting that the anterior walls of the frontal sinus were turned down with the nose. Preliminary tracheotomy was performed; the nares plugged with a sea sponge. The Rose position was maintained during the operation, as in Hochenegg's case. After rongeuring away the walls of the ethmoid cells, a narrow mesial channel (two centimeters wide) was chiseled below the ethmoid roof and carried back to the sphenoid cells. The anterior walls of the cells were then broken down and the median projection of the sella into the cells was located. The thin, bony wall of the sella was then clipped away, exposing a pocket of dura enclosing the gland. This was incised longitudinally, and a half of the exposed gland removed.

In a personal communication, Cushing mentions two unpublished cases, operated upon by him, one by turning down the nose as Kocher did, and the other by a method similar to the one employed by me.

In November, 1909, Kanavel (15), of Chicago, published a method of approach in removing tumors of the hypophysis that he termed the infranasal route. At the time of publication of the paper, the operation had not been performed upon the living subject by Kanavel. After a series of experiments on the cadaver and a trial of the various operative procedures recommended by others, he came to the con-

clusion that the hypophysis could be best reached by turning up the nose and proceeding directly to the sphenoid cells, without interfering with the ethmoid, after removing the turbinates, deflecting the septum, and cutting away the vomer.

Recently, in the Journal of the American Medical Association, West (16), of Baltimore, recommends practically the same procedure, excepting that the operation be conducted through the nose. West recommends that the operation be performed in two stages, and that the preliminary operation of removal of the middle and inferior turbinates be done under local anæsthesia. The septum and vomer are removed at the second operation, after which the cells are opened and the sella chiseled through.

In July, 1909, having in my service at the St. Luke's Hospital, a patient suffering from tumor of the hypophysis, I became interested in the operative methods proposed for the removal of tumors of this region. In the course of my work I became acquainted with Kanavel's laboratory work on this subject, and was impressed with the advantages claimed for the lower nasal route. I accordingly operated on my first patient on July 21, 1909, adopting a modification of the infranasal route which is in reality an oro-nasal operation without the trauma and disfiguration that must follow Koenig's operation. The first step of the operation is the same as pictured in Loewe's "Chirurgie der Nase," published in 1905.

The history of the case and the technique of the operation are as follows:

Case 1. H. R., male, 39 years old. He dates his illness back two years, beginning with frontal headache of a pricking, sticking character. His eyesight began to fail a year ago. The presence of aortic regurgitation and perforated nasal septum suggested syphilis, and therefore a course of mercury and potassium iodide was given by various doctors for a number of months, while his condition became progressively worse. There were no signs of acromegaly nor of the typus Froehlich, and therefore the diagnosis was not made until bitemporal hemianopsia was added to the initial general narrowing of the visual fields, and bilateral optic atrophy appeared. There was some polyuria.

Patient denied syphilis. He had rheumatism eighteen years ago, followed by aortic regurgitation of a mild character. He was injured nine years ago by a blow between the eyes, which made him unconscious for fifteen minutes. Otherwise he has always been in splendid health. Has noticed diminished sexual power for one year. He is married, but has no children. A sister has chorea. No case of tumor in the family. The father died of rheumatism.

Examination of the field of vision, made on many different occasions at the Illinois Charitable Eye and Ear Infirmary, where he was a patient between April 2d, the date of his admission, and June 25th, when he was discharged, showed contractions of the field of vision in all directions, but greatest on the temporal side. On no examination did the field of vision extend ten degrees on the temporal side, nor greater than thirty degrees in any direction. Neither was there any perception of green in either eye. The field of vision steadily diminished from the time of his admission until his discharge, when it was recorded as in the right eye, 4/200; the left eye, 5/200.

Operation July 21, 1909.

Technique. Assistants, Drs. Norval H. Pierce, Allen B. Kanavel, and H. E. Wheeler. Usual preparation. The anæsthetic was started with ether. A high tracheotomy was done and a Trendelenburg balloon canula inserted. Chloroform was now used for the anæsthetic. The nasal cavities were packed with adrenalin gauze and the pharynx tamponed. The upper lip was raised and an incision made in its mucous membrane, about five-sixths of an inch from the mucocutaneous junction, and parallel to the alveolar process. The soft tissues were freed and the nose gradually drawn up with retractors. The septum was being divided with bone forceps, and displaced upwards and laterally. The lower turbinates, the vomer, and the perpendicular plate of the ethmoid were removed. At a previous operation, at the Illinois Charitable Eye and Ear Infirmary, the middle turbinates had been removed by Dr. Norval H. Pierce. An opening was then made through the anterior wall sphenoidal sinus and a blue-colored pulsating mass seen. The membrane covering the tumor protruding into the opening into the sphenoid was incised. The tumor was then curetted out with a dull curette. The whole cavity, now the shape of a cylinder, one inch in diameter and five inches long, was thoroughly flushed with normal salt solution and subsequently packed with iodoform gauze. The septum was sutured back, and the mucous membrane of the mouth replaced and sutured, and the tracheotomy tube removed.

Subsequent history. During the first forty-eight hours the patient's temperature varied from 100° to 102°, rectally, and the pulse from 100 to 120. His condition was fair, his mind clear, and he was free from pain. At the end of forty-eight hours the packing was removed and replaced immediately by the senior house surgeon. Following the repacking of the cavity the temperature rapidly rose until it reached 105°, with a pulse of 160. The patient became somnolent and could only be aroused with difficulty. This condition lasted for twenty-four hours. Upon removing the gauze pack and irrigating the cavity, the temperature fell rapidly until, at the beginning of the fourth day, his temperature reached normal, and from that time on no untoward symptoms developed. The patient

Fig. 1. Trendelenburg canula inserted; lip retracted showing incision in mucous membrane parallel to alveolar process.

left the hospital at the end of five weeks, free from pain, and with marked improvement in the vision. The right eye was 4/200 before operation, and at the end of the second week after operation it was 6/15; left eye was 5/200 before operation, and 6/22 after the operation. He continued to improve, resuming his occupation as driver of an express wagon on the first of December, and since that time has enjoyed good health.

Detailed examination of the eyes, by Dr. C. D. Wescott. September 3, 1909. External eyes normal. The pupillary reflexes, direct and consensual, were present, but slow, and the movements of the iris slight. Wernicke's hemiopic reaction was not present. In normal light the pupils were of average size, 3 to 3½ millimeters in diameter. Vision was 6/30 with each eye. The red glass showed crossed diplopia and binocular single vision was not present. Under homatropine and cocaine his refraction was as follows:

Right: 0.75 1.00 Cyl. Ax .90 V. 6/15.

Left: 1.00 0.50 Cyl. Ax .90 V. 6/22–1.

With his glasses, his vision is doubled in the right eye, and he is able to read with either eye separately, but binocular vision is impossible. There is no apparent divergence and the excursions of the eyes seem to be normal in all directions, although it is very difficult for him to fix an object quickly with either eye.

The fields show the bitemporal hemianopsia characteristic of pressure on the chiasm, but the field

Fig. 2. Nose and lip retracted after division of septum. Turbinate bodies exposed.

of the right eye shows also a very great narrowing. It is interesting to note that the patient has a better central vision in the eye having the smaller field of vision.

The ophthalmoscope shows a pale gray disk and narrowed vessels in both eyes. There is no physiological cup and the appearance is very suggestive of secondary atrophy, but the patient has been under observation at the Illinois Charitable Eye and Ear Infirmary and at St. Luke's Hospital since April 2d, and there is no history of choked disk.

Pathological report, by Dr. Dean Lewis. The specimen consisted of several fragments of tissue which were fixed in Zenker's fluid embedded in paraffin and, after sectioning, stained with a number of different stains, such as hæmatoxylin and eosin, Van Gieson's picrofuchsin, neutral gentian, and iron hæmatoxylin. The two latter stains were employed with the idea of determining whether specific granules could be found in the cells, or whether intercellular bridges were present.

Histologically, this tissue consists of a number of

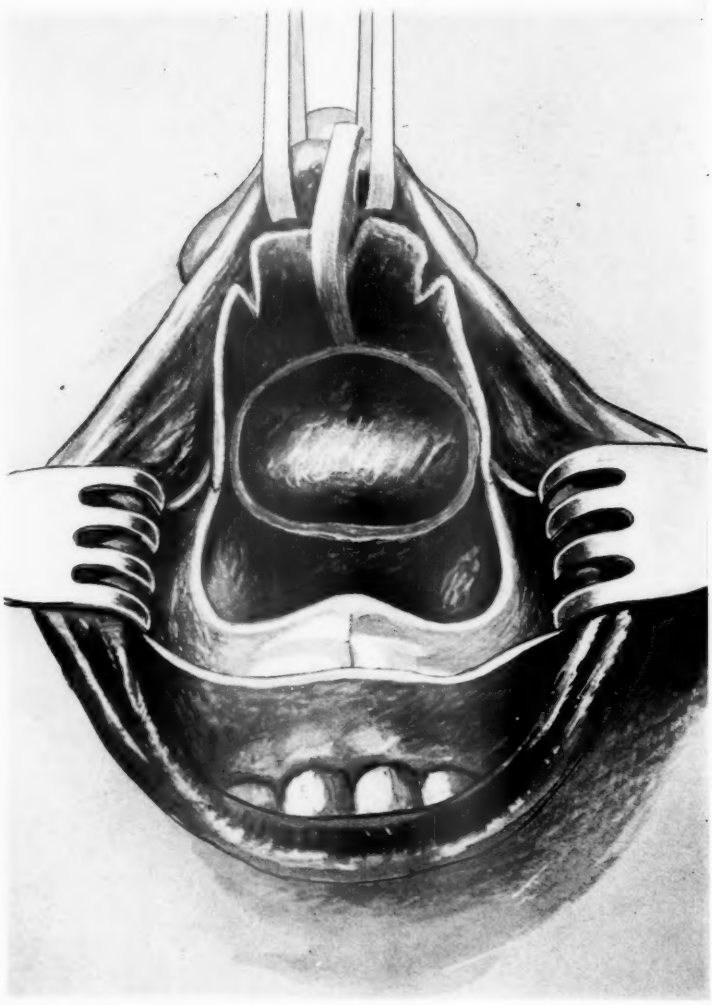

Fig. 3. Nose and lip retracted over forehead. Through the mouth is seen the nasal cavity after removal of turbinates, bony septum, and vomer. Body of sphenoid exposed.

papillary growths supported by a delicate connective tissue stroma. In some sections distinct groups of polygonal cells are found. This polygonal form is evidently due to the transverse cutting of cells, to be described later. The cells resting upon the connective tissue stalk are columnar. They have at their base a clear cytoplasm, but the peripheral part of the cells usually is composed of a cytoplasm, which stains more heavily with eosin. In none of the cells is there any evidence of keratohyalin. As yet no intercellular bridges have been demonstrated. In some cases granules have been stained within the cells, but in most instances these granules seem to represent nodal points in the spongioplasm of the cell. In some places the columnar cells seem to be arranged around a lumen, which is very small, which seems to contain in some instances a little mucoid material.

The histological significance of a tumor of this character occurring within the sella turcica is a little difficult of interpretation. It corresponds in many

ways with the tumor described by Saxer, originating from the infundibulum, which he believed to have originated from the cells of the pars intermedia of the hypophysis.

This tumor has later been regarded by Erdheim as originating from embryonal pharyngeal epithelium, which in some instances lies encapsulated in the anterior part of the anterior lobe of the hypophysis. He has found this undifferentiated pharyngeal epithelium in ten out of thirteen hypophyses examined by him.

The growth is an epithelial tumor developing in the sella turcica from fragments of undifferentiated epithelium developing from the craniopharyngeal duct.

CASE 2. The second patient was an unmarried woman, aged 32. Was referred by Dr. Hugh T. Patrick. Her illness began two years ago, with eye symptoms, which progressed under various diagnoses until the appearance of bitemporal hemianopsia, optic atrophy, severe headache and vomiting, with some rather slight acromegalic changes, made an unmistakable picture. Her menses have been irregular for over twelve years, but not diminished in amount. No polyuria, adiposity, or changes in the external sex characteristics. Constipation marked. Her mother died of a uterine tumor.

Eye findings, by Dr. Wanamaker. Vision, left eye, counts fingers at two feet, when placed at the nasal side. Vision, right eye, equals 91200 — no Jaeger. She has been wearing, left eye x 0.25 s = x 0.50 c. ax. 90; right eye, x 0.75 s = x 0.50 c. ax. 90. Her glasses did not improve her vision, neither can it be helped by any lenses. Lids, conjunctiva, and cornea normal. Her pupils are equal, about 4 mm. in diameter. React sluggishly to light, the left more so than the right. Wernicke's pupillary reaction sign present. Tension, both eyes, normal. Muscles, O. K.

Ophthalmoscopic examination showed: Left eye: media clear; nerve head of a dirty white color. The pigment ring is irregular, veins are distended and rather tortuous. Fundus, right eye: Nerve head is a dirty gray, veins are also distended.

Retinoscopy: Shows scarcely any refractive error B. E.

Field of vision. Left eye: Patient unable to recognize colors, but could see motion in a contracted degree to nasal side.

Right eye: Could not recognize red or green colors.

The field for white was slightly contracted on nasal side and field for blue considerably contracted — absolutely no vision to the temporal side. See perimeter charts.

Operation, at St. Luke's Hospital, January 3, 1910.

Technique. Usual preparation. The anæsthesia was started with ether. A high tracheotomy was done and a Trendelenburg canula inserted. Choloroform was now used for the anæsthetic. A gauze tampon was packed into the pharynx and aditus laryngis. The upper lip was raised and an incision made in its mucous membrane, about five-sixth of an inch from the mucocutaneous junction, and parallel to the lip. The upper lip was then separated from the superior maxilla by blunt dissection and use of the elevator and gradually retracted.

H. R. (case 1). Photograph taken two and one-half months after operation.

The alæ and cartilaginous septum were reflected upward and held by retractor. The nasal cavity was opened and the turbinates, vomer, and the perpendicular plate of the ethmoid were removed. The anterior wall of the sphenoid sinus was removed by the Hajek punch and pliers. The hæmorrhage was stopped by packing with adrenalin gauze for five minutes. The posterior wall of the sphenoid sinus was then removed by the Hajek punch and pliers. Hæmorrhage was again stopped by an adrenalin tampon. The fatty tissue of the hypophysis capsule was next removed and then a cyst-like structure with gelatinous contents, not unlike soft granulation tissue.

The whole cavity was packed with iodoform gauze, four strips, two coming from the nares and two from the mucous membrane incision. The septum was not sutured back nor was the mucous membrane sutured. The tracheotomy tube was not taken out, nor was the packing in the pharynx removed until the patient was back in bed. Then the packing was removed, when she had regained consciousness, and the tracheotomy tube somewhat later. Patient's pulse was then 140.

Just before the conclusion of the operation the patient suddenly stopped breathing, though her pulse remained unchanged. The tracheal canula was removed and found to contain a clot of blood. Patient was very slow in reacting to stimulation (camphor and ammonia), and to artificial respiration. It was nearly three-quarters of an hour before she was breathing naturally again. The pulse, however, remained

strong at all times and increased only about ten beats in rapidity (120 to 130).

The patient had been taking urotropin, thirty grains daily, up to the time of operation, at which time it was stopped. Ten hours after the operation, at 9 P. M., her temperature went up to 105°; pulse 136; respiration 28. She had a temperature of over 102° since it was first taken, three hours after the operation. Examination showed no rigidity of the neck, slight headache, no Babinski, no tache-cerebrale or increase in the reflexes. No cutaneous hyperæsthesia. Lungs negative. The packing was removed. It was odorless. No pus present. Normal salt irrigation.

The next morning at seven o'clock temperature was 104°, pulse 160, respiration 32. Lung examination negative. No physical signs of meningitis. A lumbar puncture was not made. The patient died at two o'clock in the afternoon of the same day. Shortly before death her temperature was 107.4°, pulse 160, respiration 48. A post-mortem was not allowed.

The cause of death seems doubtful and seems to lie between a central circulatory disturbance, and an absorption of crushed hypophysis material. That it was a meningitis fulminans seems less probable.

Histologic report of specimens, by Dr. Dean Lewis. Several pieces of tissue were handed me for examination. These were fixed in Zenker's fluid and imbedded in paraffin. The sections were stained with hæmotoxylin and eosin — copper chrome — hæmotoxylin, neutral gentian and Van Gieson's picrofuchsin. Some of the tissue proved to be pharyngeal epithelium. One piece was from the anterior lobe of the hypophysis. The histologic picture varies in different fields. In some the development of connective tissue is marked, the hypophyseal cells lying in columns surrounded by a fairly dense connective tissue. In the areas presenting the most noticeable changes the cell columns are large and apparently fused, for they are much wider and the cells are more closely packed than is the case in the normal hypophysis. The connective tissue surrounding the separate columns is often greatly reduced in amount and the fusion between the different cell columns can apparently be traced in the different sections.

It is difficult to judge of the relative proportion of the different varieties of cells. In the eosin preparations the chromophile type seems to predominate. In the copper chrome preparation transitional stages can be traced from the chromophobe to the heavily staining chromophile cell loaded with granules. None of the large empty cells described by Scaffidi and Cushing, which they described as the exhausted phase, are found. Karyokinetic figures are seen in some fields.

Histologically there is hyperplasia with adenoma formation, and while no definite statement can be made concerning the proportion of the different cellular elements, it can be stated definitely that the adenoma is not composed entirely of chromophobe elements.

BIBLIOGRAPHY

1. CATON AND PAUL. Brit. Med. Jour., 1893.
2. STUMME. Arch. fur Klin. Chir., bd. 87.
3. KRAUSE. Die Deutsch. Klin. am Emgange des 19 Jarhunderb, bd. 8.
4. BORCHARD. Centlb. fur Chir., 1908.
5. KILIANI. Annals Surg., 1904.
6. SILBERMARK. Wien. Klin. Woch., No. 13, 1910.
7. CUSHING. Annals Surg., Dec., 1909.
8. DAHLGREN. Cited by Stumme.
9. KOENIG. Berl. Klin. Woch., 1900, p. 46.
10. LOEWE. Chir. die Nase, 1905, Zertsch. f. Augenheilk., bd. xix, p. 5.
11. GIORDANO. Cited by Schloffer.
12. SCHLOFFER. Beitrage zur Klin. Chir., bd. 50.
13. MOSKOWIEZ AND TANDLER. Wein. Klin. Woch., 1907, p. 714.
14. V. EISELSBERG. Wien. Klin. Woch., 1907, p. 1341; 1908, p. 1115. German Surg. Cong., 1908.
15. KANAVEL. Jour. Am. Med. Association, Nov., 1909.
16. WEST. Jour. Am. Med. Association, April 2, 1910.

NECROSIS OF THE BLADDER WITH EXFOLIATION

A Consideration of the Subject, with Two Previously Unreported Cases

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THE writer, having had the opportunity during the last few months to observe two cases of this extremely interesting and fortunately very uncommon condition, trusts that a brief presentation of the subject will be of interest.

I will give the course and clinical histories of the two cases before taking up the different aspects of the subject in general. These two cases are very similar and are good examples of a certain type of the lesion.

Case 1. Thirty-three years of age, primipara. Previous and family history negative. On March 18, 1906, she had a long, hard labor, with a difficult high forceps delivery. She had post-partum retention and had to be catheterized; in spite of precautions cystitis developed. Two weeks after delivery, dysuria and considerable difficulty in passing urine. Nurse noticed small yellow mass at meatus, next day this mass was larger, and on the third day a large yellowish-white spongy membrane, streaked with blood, was passed. There was considerable bladder irritation and hæmaturia for three weeks after passage of the membrane. This became gradually less, but the pain in the bladder and urethra persisted for several months. There was almost complete incontinence.

About three months after delivery a plastic operation on the perineum was performed, which was partially successful. She was seen September 6, 1907, by Dr. Garceau, to whom I am indebted for this note: "When awake and lying down bladder control is fair; when asleep there is dribbling; when on her feet can retain urine one hour only. No pain, no irritation. Examination, lacerated perineum, retroversion, a dense band in the right side of vagina. Cystoscope shows urethra three-fourths of an inch long, sphincter closes transversely, closure fair. Bladder capacity 90 cc. Urine clear. No vesico-vaginal fistula."

The writer first saw her on February 19, 1909, twenty-three months after the exfoliation. The history and condition were as follows: She can hold urine about an hour when up and about, but on laughing or coughing or any sudden unguarded movement, there is incontinence. She has to urinate five or six times at night. Sometimes there is incontinence all the time. Once for a week, following an electrical treatment, she had almost perfect control, but after a second treatment condition returned as bad as ever. There is no pain or irritation. Examination: General condition good. Locally there is a cystocele, rectocele and retroversion, and a cicatricial band in right side of vagina.

Plate 1. Membrane passed by urethra, composed of mucous and submucous coats of the bladder with some elastic fibres; mounted on glass cylinder, actual size. (Dr. J. C. Warren's case, table No. 30.)

Urine spurts from catheter as soon as it has passed a little way beyond meatus. Urine clear, one or two flakes, pale, acid, 1012, no albumen. Bladder capacity, two ounces. Cystoscopy was unsuccessful, as fluid was rejected at once.

March 9, 1909. Patient thinks she has had a little better control. Bladder more tolerant, two and one-half ounces injected but held with difficulty. Cystoscopy still unsatisfactory, but in the glimpse obtained bladder wall looked unusually white.

March 16. The day following the last examination the patient had been better than at any time since her confinement (except for the week mentioned) up to

Plate 2. Much thickened bladder with large diverticulum containing partially exfoliated mucous membrane. (Specimen No. 4968, Warren Museum, Harvard Medical School; male table case No. 15.)

9 o'clock in the evening, when she had an attack of intense pain on micturition which was accompanied with considerable difficulty. Frequency and pain continued all night, there was, however, no incontinence. Next day the discomfort was much less and the following day had disappeared entirely. She has never had a similar attack. Whether the cystoscopy, which was a short examination, was entirely or only partially the cause of this seizure, I am unable to say, but I think the cystocele had something to do with it, for difficult micturition is common in this condition.

Cystoscopy. Urine perfectly clear, few fine flakes. Bladder retains two and one-half ounces. Bladder wall appears white, especially so at top, but it does not seem to be as strikingly so as last time. In places the wall shows trabeculation. In other places there is a suggestion of mild chronic cystitis, that is, the vessels are injected. The ureteric orifices are seen with difficulty, the capacity is so small that the manipulations of the instrument cause pain. The left orifice appears normal and the right widely dilated. The trigone was not well marked and paler than usual. Whether the slightly red appearance of the bladder is connected with the recent attack of pain and difficulty I cannot say at present, as this is the first time that the examination has been satisfactory in any degree.[1]

[1] Since this article was sent to press I am able to add the following: September, 1909. The patient has been having bladder irrigations about every five days with boric acid solution given to the point of toleration of distension. The bladder capacity is now four ounces. During the day there is good control, the intervals between micturitions having lengthened to two hours, at the end of this time there is however, an imperative desire, which, if not relieved, leads to incontinence. On the whole the condition is very much improved. I attribute the improvement to the relief of a certain amount of chronic cystitis which was present. The urine is now clear, with a few flakes which are made up of squamous epithelial cells.

CASE 2. This patient was seen by my colleague, Dr. A. L. Chute, about three months after her confinement and I am indebted to him for permission to report the case, and for the notes of the first cystoscopy. The history is as follows: Woman thirty years old, previous general and urinary history negative. Two children, first pregnancy and labor normal. One and a half years later second labor (July 5, 1908), duration 10 A. M. to 3 P. M, difficult instrumental delivery. Late in the evening she had to be catheterized. She was catheterized the following morning and evening. On the second morning after delivery she thought she did not need to be catheterized as the urine had started to run. In the evening, however, she had to be catheterized because of the extreme pain from bladder distension and in spite of the overflow which had been going on all day, a large quantity of urine was obtained. From that time on the patient has had incontinence. The urine soon became foul in spite of twice a day bladder irrigations. Three weeks after delivery there was a sudden complete retention. The attending physician was immediately summoned and found something protruding from the urethra. Pulling upon this he delivered a large, dirty yellow, foul mass. Patient said this was larger than the hand and filled an ordinary jam jar about one and one-half inches from the bottom.

September 30th (about three months after confinement). She has suffered constantly from her bladder. Incontinence when on her feet; while lying down there is a certain amount of control, but she is obliged to micturate from four to six times a night. The patient is in good general condition. There is a moderate perineal tear, no vesico-vaginal fistula. Nothing remarkable about external meatus. Some excoriation of the neighboring parts. The bladder contained one ounce of foul, turbid urine. Urine pale, foul, turbid, 1004, slightly acid, slight trace of albumen. Sediment considerable, pus free and in clumps, normal and abnormal blood, many round cells, but no squamous cells. Large number of bacteria. Stained specimens show many bacilli and cocci.

Cystoscopy. With a large catheter bladder could be made to hold three ounces of boric solution. Bladder wall everywhere fiery red with masses of shaggy mucopus adherent, nowhere is there any suggestion of normal mucous membrane. The ureters seem to be tremend ously dilated. There was marked tenderness and considerable bleeding.

January 20, 1909 (about six and one-half months after confinement). The condition has gradually improved since last examination. She has been having bladder irrigations with boric acid solution and weak silver nitrate solution 1-5000. To-day for the first time she held urine while on her feet for one and one-half hours; while lying down control somewhat better. Micturition is still painful. The urine examination is the same as of last date, except that the odor is not particularly offensive and the sediment is less.

Cystoscopy. Capacity same, three ounces. The bladder is not nearly so red, so light absorbing, nor so sensitive as of last note. In one place the wall is taking on a whitish look, no blood-vessels seen. There appear to be two good sized cavities in place of the ureteric orifices. Five days later a ureter catheter passed into the left one of these cavities and several drachms of clear urine were obtained (bladder urine turbid), thus proving that they are the widely dilated and very abnormal looking orifices of the ureters.

February 24 (seven and one-half months after confinement). Urine still turbid. Incontinence and bladder pain same.

Cystoscopy. Capacity same. Bladder much improved in appearance. Picture much clearer. The two cavities, which are the ureteric orifices, can be clearly seen. To the outside of the right ureteric opening is what appears to be a shallow diverticulum. Unsuccessful attempts to catheterize right side, bladder had become intolerant.

March 18. Urine turbid with shreds. There is constant slight hæmaturia. If patient empties bladder she remains dry for three-quarters of an hour, after this, complete incontinence.

Cystoscopy. Same as of last note, except much clearer view, large cavernous ureters very distinct. Capacity three ounces.

It is to be regretted that no histological examinations were made in either of these cases, as without them the reports are necessarily incomplete. However, the writer has no doubt, by the subsequent clinical course and the cystoscopic findings, that these were true cases of exfoliation with a very considerable involvement of the muscular coat, as shown by the capacity of the bladder and the loss of sphincteric control. The etiology and prognosis in these cases will be considered under these headings.

History and nomenclature.[1] The passage of membranes from the bladder has been noted since very early times, as shown by an article by Willis (1) in 1650, and a case reported by Tulpius (2) in 1716. The earlier writers thought parts of the mucosa itself were expelled. This was later contradicted by Fontaine (3) and others, and opinion differed from time to time. Soon, however, cases were reported in which the histological examinations showed bladder tissue to be present in the extruded membrane. Luschka's (4) report on Bauer's (5) case, in 1854, and the cases of Lever(6) and Lee (7) being the earliest accurate accounts. The reason for the then existing confusion being the number of different names under which the lesion was described. Even now the condition is very lightly dealt with by most text-books and is variously referred to as "membranous," "pseudomembranous," "croupous," "diphtheritic," "exfoliative," "plastic" and "gangrenous" cystitis, which terms are inadequate and misleading.

It is a well established fact that there are two distinct conditions: First, the false or pseudomembranous type, which may correctly be called "croupous" or diphtheritic" where the membrane is a fibropurulent exudate, and second, the true form where portions of the various structures of the bladder wall have been cast off. This has been proved repeatedly by microscopical examinations. Guyon (8) has described these conditions very fully in a clinical lecture published in 1887. The second group is the one with which we are mainly concerned.

These cases should be described under the name of "necrosis of the bladder" as suggested by Haultain (9). The process may be of any severity and involve any or all coats of the bladder and occur with or without exfoliation That the process is a true necrosis has been shown by experiments and pathological examinations which I shall show later on.

Pseudomembranous type. First, a few words in regard to the pseudomembranous type. It is impossible to differentiate clinically, without histological examination, between the two conditions, as is well shown by the following cases which are selected because a pathological report is given. They are as follows:

Balvay (10). Man, 65, with a twenty-four hour retention, no previous history, except that he had been catheterized for a previous retention. Bladder distended to the umbilicus; no instrument could be passed per urethra; suprapubic puncture unsuccessful; suprapubic drainage, several large pieces of membrane removed. Examination: Layers of fibrin containing pus cells and red corpuscles. No bladder tissues present. Many colon bacilli. Pseudomembrane.

Harrison (11). Delivery by version. Had been catheterized for a week, cystitis developed. On the eighteenth day a membrane passed from urethra. Examination: Fibrin with red blood corpuscles, the whole in state of fatty degeneration. Thought to be an organized hæmorrhage.

Guyon (12). Man, 53. Sudden retention, previously difficult micturition for three months. Cath-

[1] A full account of the early history of this subject can be found in the thesis by Pepin (21).

eterized for five days. Urine became foul. Something over a month later complete retention. Catheterized; urine ammoniacal and fœtid, constant drainage at night. At end of six days passed by urethra a large membrane. Examination showed no organized tissue present.

Savor (13). Woman, 58. Operation for tubo-ovarian cyst and carcinoma of tube. Had had some urinary symptoms previous to operation. Fourth day after operation acute cystitis. Eighth day began passing pieces of membrane which continued for a week. Examination: Many pus cells in a network of fibrin. No bladder tissues.

The formation of a pseudomembrane is not infrequently due to the traumatism and infection during catheterization with the resulting cystitis and the contact of the bladder mucosa with purulent, ammoniacal urine (Balvay). It may also be associated with stone in the bladder, cases being reported by Dolbeau (14). The symptoms do not differ materially from the true form, but the differentiation is important because of the prognosis, complete recovery taking place when the membrane is passed or removed, which may be quite the reverse in the true form. Death results if the membrane is retained.

Appearance and composition of exfoliated membranes. We will now return to the consideration of the second or true type. These membranes are generally passed by the urethra in the female. When not so passed they are found, either at operation or at autopsy, more or less separated from the remaining portion of the bladder wall; sometimes as a completely separated sac containing purulent urine (case of Jacobi, male table No. 3). This accounts for the great difficulty experienced at times in passing a catheter. The membrane may take the form of a cast of the entire bladder, sometimes showing the holes for the ureters, or it may come away in fragments of any size, the membrane in Dr. Warren's case (see cut) being the size of a lady's small handkerchief. In gross appearances the membranes are described as being of a dirty gray or yellowish white color and having a foul odor. They are of varying thickness, from one-eighth to one-third of an inch. One surface has a rough, gritty feel, from the secondary deposit of urinary salts, and the other surface is smooth and may be of a darker color; this surface having been in contact with the remainder of the bladder.

By referring to the table it will be seen that in a number of cases the membrane is described as being composed of the mucous and submucous coats, often with portions of the muscular coat and in a few cases portions of the peritoneum as well [Haultain (9), case 1].

Unfortunately no histological examinations were made in either of the two cases here reported. There are, however, careful examinations on record which I shall quote to show what occurs. The microscopic examination in the case of Margulies (male table No. 14) was as follows: First, necrotic, smooth muscle fiber, arranged as in normal bladder. Second, connective tissue layer of varying thickness to which is attached in places, pieces of necrotic mucous membrane. The blood-vessels in the section were dilated and choked with lime salts (phos. of cal., with am. and mag. phos., probably of secondary origin). Necrosis of muscle was shown by the poor staining and absence of nuclei. The entire thickness of the membrane was filled with bacteria of different kinds, separated and in colonies. Haultain gives with great detail the findings in two cases, one showing the presence of all the coats of the bladder, including a piece of the peritoneum. The blood-vessels were intensely engorged and degenerated, and the various layers showed marked degenerative changes. In the second case the mucous and submucous coats were so altered as to be unrecognizable. In the muscular coat the fibers were swollen and indistinct and minus their nuclei. The vessels were engorged and their contents granular. In other words, both these specimens showed changes due to a coagulation and hyaline necrosis secondary to extreme congestion of the blood-vessels, the process in the last case not being so far advanced.

Instances could easily be multiplied, but these are sufficient to show that the underlying cause must be capable of producing a true necrosis which may involve the structure of the bladder to any depth. This brings us to the etiology of the condition.

Etiology. Taking as a starting point the proposition that this condition is a necrosis, what are the causes of necrosis? The newer

pathologies (15) divide the causes into two groups.

First, direct causes, producing immediate cellular death, they are: (*a*) Chemical and bacterial toxins. (*b*) Mechanical injury. (*c*) Effects of heat and cold.

Second, indirect causes, by interference with the blood supply in various ways: (*a*) Injury or disease of the blood-vessels. (*b*) Embolism. (*c*) Disturbances due to nerve influences. (*d*) Mechanical closure, by ligature, by pressure, or by overstretching the tissues. Any of these causes may be aided by general conditions which weaken the tissue resistance, as age, diabetes, nephritis, acute disease (typhoid fever), debility, etc. The extent of the process is greatly increased by the secondary introduction of bacteria.

Now to apply these various causes to the clinical aspect. By consulting the table it will be seen that the predisposing conditions met with in the female are most commonly retroposition of the pregnant uterus, difficult or prolonged labors, and incarcerated or twisted tumors of the uterus and pelvis. In almost all of these conditions there has been as well an associated retention of urine, sometimes to very great extent (Cocram, table No. 27).

In the male cases retention was present in the majority of cases. In other words, in a majority of all cases pressure on the bladder wall from within or without, or both was or had been present. Therefore, we must accept the fact that this pressure causes in some way an interference with the circulation and plays a large part in the etiology. There are, however, a few cases in the table where neither obstetrical pressure nor retention were present. Here we must take as our etiology the first or direct cause, that of destruction of tissue by bacterial toxins or to assume that an inflammatory process of sufficient severity occurs in the submucous or vascular coat, to occlude by pressure the numerous and delicate blood vessels with the resulting necrosis. More of these cases later.

To return to the effects of interference with the circulation, these have been very carefully put forth in a most excellent monograph by Haultain, and I shall only very briefly review them here. In the first place the blood-vessels of the bladder enter and leave the organ at its base and neck. Any pressure here will, therefore, affect the circulation of the organ.

It is of interest here to note a series of experiments that were performed on rabbits by Heubner (16). He ligated the bladder neck for a period of two hours, after which the circulation was allowed to resume. The animals were killed at various times from a few hours to five or six days later. Examination of the bladders of these animals showed the same conditions of necrosis to be present as has been already described, thus proving that even a temporary interruption of the circulation may cause this condition. He then goes on to state that pressure on the bladder neck is clinically produced by retention of urine and by pressure of the fœtus during labor.

That retention of urine alone can cause necrosis of the bladder was proved by a series of experiments by May (17), who produced artificial retention in dogs.[1] In this connection the case of Dean (male table No. 9) is of interest, a two day retention from impacted urethral calculus, also the cases of retention following surgical operations, Kelly (table No. 17) and Esau (male table No. 10).

Haultain believes that retention causes circulatory obstruction by preventing the venous return. This is explained by the fact that the base and neck of the bladder, which contain the main vessels, offer the greatest resistance to distension by urine during retention, being the fixed part of the bladder. That the veins suffer, 1st from the normal absence of blood pressure, 2d from their compressibility, and 3d from their more superficial position. The arterial supply is not so interfered with, hence the resulting tremendous congestion followed by necrosis.

When retention is associated with an incarcerated pregnant uterus,[2] the chances for necrosis are increased, as the venous return is already interfered with to a greater or less

[1] In these experiments retention was maintained until death occurred in two cases (sixty hours). In these cases the bladder wall was found to be the site of extensive hæmorrhages, particularly in the submucous coat. The mucosa and submucosa were separated at the fundus by an extravasation. The urine was filled with blood and epithelium. In three others the retention was continued intermittently for periods of twenty to thirty hours at a time for three weeks. Examinations of the bladders in these cases showed the mucosa and submucosa broken down and filled with granular material. The blood-vessels were engorged. The urine was ammoniacal and filled with detritus.

[2] Pinard and Varnier (22) have written extensively on the association of this condition with retroverted pregnant uterus.

extent. Retroverted pregnant uterus alone, however, does not seem to exert sufficient pressure to produce necrosis, as in neither Haultain's collection of cases nor my own has exfoliation occurred without an associated retention. It is, however, the cause of the retention and greatly aggravates the condition.

The most unique cause of retention was in case 1 of Gottberg (table No. 21) where a vaginal tumor existed which proved to be a bicornate uterus with atresia and retained menstruation on the left.

In Vahle's case (table No. 3), there was an incarcerated myoma of the uterus with an enormous retention.

When the obstruction of the circulation is due to labor, we have a complete shutting off of the blood supply, due to the pressure of the fœtus upon the bladder neck, with a resulting condition of anæmia. This probably occurs in either a small pelvis with a large child or some abnormal presentations. That this pressure need not be very long to produce changes in the vessels is shown by the experiments of Heubner. With the re-establishment of the circulation comes congestion, then exudation followed by necrosis. Thus we see that in the two conditions, retention and obstetrical pressure, the mechanics of the obstruction are different, the results, however, are the same, both ending in necrosis.

The two cases here reported were undoubtedly due to the second condition, both having hard forceps deliveries. In case 2 there was a retention and over-distension of the bladder In case 1, I believe the retention to have been a post-operative one and was never allowed to become extreme.

In the case of Lohlein (table No. 26) the blood supply was obstructed by the torsion of a fibroid. There seems to be good reason therefore, to assert that interference with the blood supply by retention or pressure is the primary cause in a number of these cases, that bacterial infection and the presence of a foul ammoniacal urine do much to help along I do not doubt in the least.

There are certain cases which cannot be explained by the foregoing. In Dr. Warren's case (table No. 29) there was neither pregnancy nor retention. A dilatation of the vaginal outlet was performed upon a patient who had moderate cystitis. Here was probably a slight trauma to the bladder, but sufficient to light up a severe inflammation.

In the case of Begouin (table No. 15) there was a severe cystitis following immediately the injection of a strongly alkaline solution. I think there must have been here a bacterial infection as well, as I do not believe sodium chloride would have sufficient penetrating power to affect the muscularis.

In the case of Norris (table No. 31) there is no history, except that of a severe colon bacillus cystitis. Here, unfortunately, there is no description of the membrane.

In several of the male cases (Jacobi, male table No. 3; Fenwick, male table No. 7) the only history is that of cystitis. There are also cases associated with calculi (Stein, Dolbeau, Deschamps, male table Nos. 8, 11, 12).

It is not my intention to go at all into the bacteriology of bladder inflammations, but I think the necrosis in all of these cases can be accounted for by the first direct cause of cellular death, that is, bacterial toxine or the production of a severe inflammation, occluding the vessels of a part or the whole of the wall by pressure.

There are three cases occurring with a general systemic condition: The case of Orlowski (table No. 16) following a severe dysentery. The case of Lemaire (Haultain's, table No. 49) where there was a retention during typhoid fever. Death in the 4th week, retention had persisted for two weeks. There had been difficulty in passing the catheter.

The case of Tronchet (male table No. 16) which was that of a diabetic with urethral stricture. There are two cases associated with injury of the spine, Wilks (Haultain's table No. 55) and Southam (male table No. 6) being examples of disturbed circulation due to nerve influences.

Cystoscopic appearances. Although the two cases herein reported are lacking in respect to the pathological findings, I believe the record of the cystoscopic examinations will be of value, as there are but few observations reported upon this most interesting and important feature of the subject. Few as they are, however, they will illustrate the local con-

ditions existing at different periods in the course of the lesion.

Taking the observations in the order of their clinical occurrence, the earliest in the disease is that of Norris (table No. 31) who examined a patient three weeks before exfoliation took place. This was in a case apparently due to infection with the colon bacillus, there being no other etiological feature. He found the bladder contracted, thickened, and reddened with numerous hæmorrhagic areas. The trigone was more intensely injected. There was no actual ulceration.

Next in order comes the very striking observation of Margulies (male table No. 14) who cystoscoped a male patient under chloroform two days before operation. In this case the cystoscope was passed into the interior of the exfoliated sac, which had become almost, if not entirely, separated from the remaining wall. He gives the following description. The surface was everywhere of an equal dirty, gray-white color, and entirely covered with what looked like a fine, short, hair-like crystaline deposit, this had a cilia-like motion with the currents of the bladder fluid. In places there were adherent accumulations of pus. The surface looked like "a piece of dirty, gray-white skin, covered with thickly set, dirty, short hairs." Neither the trigone nor the ureteral orifices could be recognized. There was nowhere any normal bladder structure. The picture was entirely unusual and he was unable to interpret it at the time. Of course after operation the solution was clear. I think next in order come the various appearances described in detail in case 2, reported by the writer. They cover a period of several months, showing the gradual change in the bladder and the approach to the final picture which we will come to presently. They need not be repeated.

Margulies describes the cystoscopic findings in his patient, seven weeks after operation, which are worth giving in full: Bladder holds 150 cc. The fluid is unusually pale, almost white, in places are a few, pale looking vessels. The neck of the bladder, instead of being the usual dark red, is of a pale rose color. The trigone shows no changes on the right; the ureteric orifice being normal and situated on a small papilla. The middle and left portions of the trigone have an uneven appearance under the mucous membrane. The left ureter is dilated and crater-like, but not markedly so. The effluxes are equal and normal. The apex shows a small funnel shaped diverticulum at the site of the operation wound. The shape of the bladder is very little changed. The most striking thing is the white appearance of the wall, especially on the left lateral and upper parts. This is of interest because during the early part of his illness the patient had pain and marked tenderness in the left lower abdomen. In this case a large part of the muscular coat was exfoliated and Margulies concludes that a regeneration of the necrotic parts must have occurred to a considerable extent. That the process was more extensive on the left, and the trigone and structures at the neck very slightly damaged, which accounts for the excellence of the control, urination taking place at normal intervals. I feel that the time, seven weeks, is too short to consider this as an end result.

Stoeckel (18) describes the findings in two cases of exfoliation, which are most striking. In the first case (table No. 19) the result is poor, there being incontinence and a small vesico-vaginal fistula as well. In the second case (table No. 20) recovery occurred and the condition is given at the end of one year and nine months. The pictures are very similar, but in case 2 the sphincter was not seriously involved. He considers the appearances typical of the end result.

CASE 1 (table No. 19). A very abnormal view; nothing to be seen of the trigone or normal ureteral openings. Immediately behind the sphincter two deep funnel shaped openings like diverticulæ, lay on the right and left side and equally distant from the internal orifice of the urethra. They were flat toward the median line and grew deeper towards the outside. These were the much dilated ureter mouths. There were no contractions, they remaining wide open and unchanged, but urine was seen to trickle from each. The rest of the bladder wall was brilliantly white with a few irregularly placed tortuous vessels. The sphincter was represented by a thin pale red band. Below the ureters was a small opening about the size of a normal ureter. This proved to be a vesico-vaginal fistula.

CASE 2 (table No. 20. There is a colored illustration accompanying the description). In this case the bladder wall had the same white appearance and the

ureteric openings were two large, smooth-walled cavities. The bizarre and irregular configuration of the bladder was striking, deep and shallow diverticulæ alternated with projecting bands which divided the bladder into larger or smaller portions, like septa. These trabeculæ were distinguishable by their reddish color. The ureters were catheterized in this case, some difficulty was experienced at the beginning of the ureter in passing the catheter. The base of the bladder was displaced to the left, the right ureteric orifice being in the median line and the left far around to that side.

These descriptions correspond entirely with the appearances found in the writer's case 2, the dilated ureters, the beginning diverticulæ and the beginning whiteness of the wall, the process only being in an earlier stage.

The appearances in the writer's case 1 are given in detail in the case report. While the picture was not normal by any means, no such striking changes are present as in the other cases.

These are all the observations that the writer has been able to collect.[1] There is a short description of the conditions given in Knorr's (19) book on "Cystoscopy in Women." He quotes from Stoeckel.

Symptomatology and diagnosis. The most constant clinical feature of the lesion is the condition of the urine. This is ammoniacal and fœtid, contains albumen, pus and blood, and quantities of detritus. In some cases bits of membrane are passed, containing bladder tissue from which the diagnosis can be made. The urinary symptoms include retention, dribbling from an overflow bladder and also those of an acute cystitis. There is one phenomenon which has been described in a number of cases and when met with should excite suspicion, that is, the inability to empty a full bladder by catheterization. When only a small quantity of urine or pus is obtained the catheter has been occluded by the exfoliated sac. Sometimes there are grave constitutional symptoms with elevation of pulse and temperature. In some a severe course is run without any temperature at all (Margulies' case). In some instances the diagnosis may be made by finding the cystoscopic appearances, but the symptoms as a whole are vague and unclassified. When the membrane presents at the urethra the diagnosis is clear and is easily made from that of inversion of the bladder.

Course. Necrosis of the bladder may be divided anatomically into four groups, according to the various layers involved. First, the mucosa; second, the mucosa and submucosa; third, when the muscular coat is involved as well; and fourth, when the peritoneum is included. The second class is the most common.[2]

In one of the cases, that of Robinson (table No. 32) the membrane was described as being composed of "several imbricated layers of epithelial cells, arranged as in those of a normal bladder. The cells are in part necrotic and show no leucocyte infiltration." The symptoms were slight and the recovery quick. In this case the process was certainly a very superficial one and might well be described as an "exfoliative cystitis."

When the process is limited in extent or confined to the coats, exclusive of the peritoneum, the necrosed tissue is thrown off in the process of repair as in other parts of the body. When there has been retention with stretching of the bladder, separation is said to begin at the fundus, that is, opposite to the place of greatest resistance to dilatation. It is here that the effects of the unequal elasticity of the coats are first manifested, the peritoneal and the external muscular coats being much more distensible than are the internal muscular and the mucosa. Separation having begun and being increased by the outpouring of serum, local necrosis takes place, which is soon followed by perforation of the membrane by the decomposing urine which aids in the dissecting process. This is carried on downward to the neck of the bladder (Boldt, 20). That the neck is the last place to become separated is borne out clinically, as at some operations and autopsies the membrane is found free, except at this point. The membrane is finally expelled by the pressure of the retained urine behind it. When portions of the peritoneum are exfoliated, the neighboring organs take place in the process

[1] Since this article was written Dr. F. R. Hagner of Washington has reported a case of necrosis of the bladder (male table, case 18), in which he was able to make a cystoscopic examination. He says "Bladder capacity enormous, entire mucosa absolutely black, had the appearance of gangrenous tissue. Impossible to obtain a satisfactory view of the outline of the prostate, as it was covered with masses of gangrenous tissue."

[2] The submucosa is the most commonly affected because of the number and delicacy of its blood-vessels.

of repair, a secondary sac being formed by inflammatory adhesions, which later become changed into fibrous tissue (Haultain, 9).

Complications. General sepsis and uræmia are occasionally the cause of death. Perforation and rupture of the bladder occur, but apparently they are not common; when they do occur, however, peritonitis of a virulent nature results. We have seen, however, that portions of the peritoneum may be cast off when protected by pericystic adhesions. These pericystic adhesions occur in severe cases causing distortions of the bladder, as is illustrated in Stoeckel's case 2. The kidneys do not seem to suffer much in this condition, except in the cases of general sepsis, that is, they are rarely mentioned in the descriptions, the case of Begouin being an exception, here a nephritis was said to have resulted.

Prognosis. By consulting the table of thirty-four cases occurring in females collected by the writer, it will be seen that there were eleven deaths. In three was no exfoliation (tables Nos. 1, 2, 3); in one there was rupture of the bladder (table No. 4). In six cases the membrane was exfoliated, but remained in the bladder, one of these deaths being due to uræmia, and in only one case (case of Williams, table No. 7) did death occur when the membrane had been passed. This was apparently a badly septic case, although the notes are very meager. This gives seven fatal cases out of thirty of exfoliation. These figures are a little better than those given by Haultain, who collected fifty-three cases in the female with twenty-five deaths. Of these twenty-five, in fourteen there was no exfoliation, eleven of which were due to rupture of the bladder and three to sepsis or uræmia. Leaving eleven fatal cases out of thirty-nine cases of exfoliation, the total of the two tables being eighteen fatal cases out of sixty-nine, which does not seem a high death rate considering the gravity of the lesion and the fact that in some of the cases which recovered portions of the peritoneum were exfoliated (Haultain's case 1, which is No. 40 of his table, also cases 18, 26, 34, same table). Some of the cases associated with retroposition of the uterus with urinary retention extending over a number of days seem to be very fatal.[1]

In regard to the writer's table of eighteen cases occurring in males, there were eight deaths. In five of these (Bosc, Jacobi, Clarke, Southam, and Museum specimen) detached membranes were found in the bladder at autopsy, one being associated with a diverticulum (Museum specimen) and one case had a fracture of the spine (Southam). The sixth case (Stein) had passed pieces of membrane, but died probably from renal insufficiency or sepsis, having had renal calculus and pyonephrosis. The seventh case (Tronchet) was in a diabetic, and in the eighth (Pepin) operation was so long delayed as to be useless. In the remaining nine cases the membrane was either passed or successfully removed by operation. Haultain gives three fatal cases in men.

The prognosis in general should be guarded, but may be said to be excellent as regards life in both sexes, if the membrane is not retained. Retention of the membrane is followed by death.

As to the functional restoration of the bladder or the end results, these vary all the way from complete recovery to complete incontinence. When the damage has been severe, however, the bladder capacity and control are more or less injured. In the writer's opinion the disability is in proportion to the extent of the destruction of the muscularis, and particularly to the middle layer which is continuous with the sphincter. When the vesical neck and trigone are injured to the extent observed in Stoeckel's case 1 and the writer's case 2, it is not surprising to find incontinence, there being not only distortion and contraction of the bladder, but almost complete destruction of the sphincter as well. If on the other hand, the trigone and vesical neck are only slightly involved, even though a large part of the muscular coat be lost, as in the case of Margulies, functional recovery may take place. He believes that a true regeneration occurred in his patient; the time, seven weeks, seems short to the writer. Be that as it may, we know that large parts of the bladder have been resected surgically both by accident and intention, and that good functional recovery has occurred

[1] According to Duhressen (23) when the retention has persisted fourteen days, necrosis always takes place, no matter what the treatment (see cases Gervis and Vahle, table Nos. 1 and 3).

when the more complicated structures of the base have not been disturbed. When the mucous and submucous coats only are affected good recovery will probably take place.

It may be of interest to add here that Dr. Warren's patient is living in this city and is perfectly well, more than fourteen years after the exfoliation. Here, however, the membrane contained elastic fibers, but no muscle. Unfortunately there are only very few accurate descriptions of the final results. In the writer's cases, case 1 being now over two years since the exfoliation, may be taken as an end result. Before treatment the condition was a distressing one, there being incontinence on any unguarded action, as laughing or coughing. After several months of forcible bladder irrigations the control is, however, much improved, micturition taking place about every two hours during the day. At times at night there is incontinence. There is no pain or inflammatory condition, but the capacity is small. At present it seems as if the end result in case 2 would be the same, if not worse, there being very little power in the sphincter.

Treatment. This must be symptomatic at first, consisting of the ordinary internal and local measures used in cystitis. Should retention or difficult micturition be present, constant drainage should be established. If constant drainage fails, drainage by cystotomy is indicated. Of course if the membrane presents at the meatus it is to be removed, followed by frequent intravesical irrigations.

In the cases occurring in men the only hope of recovery is in operation. Although the diagnosis has rarely been suspected the symptoms are fortunately so severe as to demand an exploratory operation. The suprapubic route is preferable. It is a noteworthy fact that all the male cases operated on have recovered, with the exception of case 15, where the membrane was in a diverticulum (see cut) and case 17, where operation was too long delayed.

It seems to the writer that opening the bladder above with complete removal of the membrane and more adequate drainage than afforded by the urethra would yield better results in some of the very septic cases occurring in women, particularly when there is intermittent retention from fragments. No such cases are however reported, the nearest being that of Arroyo (table No. 28) where a vesicovaginal fistula was dilated for better drainage.

Male cases. These cases have been referred to in part in the paragraphs on etiology and prognosis, but there are certain points which will be of interest to take up a little in detail. The most striking fact in the series is the excellence of the result obtained from the operative removal of the membrane. These good results have naturally been mostly among the more recently reported cases, where operation has been undertaken early for obtaining satisfactory bladder drainage. For this reason cases will be reported with increasing frequency in men, although there is little doubt that the disease is much more common in women, because of the complications which may occur during pregnancy and labor.

Spontaneous cure, by passage of the membrane, occurs in a large proportion of the female cases because of the shortness and dilatability of the urethra. This has been reported but once in the male, the case of Buchanon (male table No. 2) where a complete cast of the bladder was passed per urethra, said to have resembled the mucous membrane. There was no examination, but the case is unique in that so large a membrane should be passed per urethra. In Stein's case (male table No. 8) fragments of membrane were so passed. The passage of the membrane entire as well as in pieces has been noted when there has been a perineal wound (male tables Nos. 4, 7, 11, 12, 13, 14). It will be seen by the table that retention, severe cystitis or calculi were present as factors in the etiology in all of the cases but one. That is the case of Margulies, here the etiology is very obscure. This case I have cited so frequently that I think it will be of interest to give a more detailed abstract than is to be found in the table. The original article contains the most complete case report that has been published. It is briefly as follows:

A man, aged 34 years, single, entered hospital July 30, 1903, with difficult micturition, pain and hæmaturia; gave the following history: Previous to his 28th year

had had several attacks of urethritis at intervals of one to one and one-half years, for the last seven years good health. In March, 1903, after exposure, had a moderate urethral discharge which yielded to treatment in six weeks. Urine was then clear. In May, 1903, severe pain in ankles and back, diagnosed as a gonorrhœal condition, he was in bed for a month and a half, and later went to a seaport sanitarium, where he took a course of treatment of baths, etc. For the last three months there had been no sexual exposure, he was feeling well, and was about to return, the only trouble remaining being an obstinate constipation lasting from six to seven days. He went to bed feeling perfectly well, at 3 A. M. got up with tremendous desire to micturate but was unable to do so. After repeated efforts, there was priapism followed by urine and blood. In spite of passing urine the desire continued, followed by almost clear blood every ten to fifteen minutes. Treatment: Ice, ergot, and bladder irrigations. This condition persisted twenty-four hours, nearly exhausting the patient. Urine was turbid, showed blood, albumen, no kidney elements, no odor, no bacteria, was neutral, 1018 sp. gr., a moderate number of leucocytes in the sediment.

The local condition gradually improved and at the end of six days the patient decided to leave for the city. There had been severe pain all this time in the left side of the abdomen.

Examination: Abdomen somewhat large and tender, especially on the left. Palpation showed an enormous fæcal accumulation in colon. Bladder region sensitive, No. 18 sound, urethra uneven, prostatic urethra tender. No stone felt. Prostate small, firm, and slightly tender. Bladder capacity diminished. Urine, dark, bloody, turbid, no odor, sp. gr. 1024, albumen present. Sediment contained pus, blood crystals, no kidney elements, no gonococci or other bacteria. For three days no improvement. Bowels were cleared. Put on constant drainage for a few days with bladder irrigations. In a few days condition improved, urine cleared and contained less blood, abdominal pain almost gone.

On eighth day after admission awakened suddenly by an attack similar to the one described, attempts at micturition bringing only a few drops turbid urine and blood. This persisted for twenty-four hours, yielded to ice and morphia. After a few days constant drainage again put in, urine again contained pus. A week later again improvement under the same treatment. Suddenly a third attack similar to the others lasting twenty-four hours. This time the pain subsided, but the urine contained an increased amount of pus and crystals. From this time on the condition became worse, the urine becoming more foul. Micturition difficult, constant drainage was not tolerated. The bladder could not be emptied with a catheter, only a few drops of pus obtained and irrigation fluid would not return. Operation advised but refused. Patient agreed to be put under chloroform in the hope that a cystoscopic examination could be made. This was done the next day, September 2d. (The findings have already been given under "cystoscopic appearances.") The day following this there was severe suffering from painful and difficult micturition and the patient asked for an operation. On September 4th suprapubic cystotomy was performed. A gray looking mass presented which was easily removed as it seemed to be unattached. This gave the appearance of the removal of the entire bladder. There was almost no bleeding. The remaining wall was red and granular looking. The convalescence was uneventful. The structure of the membrane and the other features in this case have already been given.

That this extraordinary case was one of true necrosis is shown without doubt, but the primary cause is obscure. It is probably due to some bacterial infection, as three seems to be no other reason to suspect an interference with the circulation.

Table. In making the table I have taken from the case reports what seemed to me to be the interesting and essential features. The reports varied greatly in their completeness and must be taken at their face value. I have purposely refrained from abstracting any of the cases collected by Haultain. The reference portion of his table is added for the sake of completeness. The results given as recoveries do not in any sense refer to the local conditions. Those wishing the details are referred to his, or the original articles.

Conclusions. From this brief presentation of the subject I think the following conclusions may be drawn:

1. Necrosis of the bladder occurs as a result, primarily, of interference with the circulation of the organ, aided by bacterial infection.

2. The interference with the circulation may be produced by mechanical pressure outside the bladder, or by bacterial inflammation within the bladder wall.

3. The condition is more common in women than men.

4. The clinical symptoms are vague. Retention (when associated with cystitis) which cannot be relieved with catheter should excite suspicion.

5. There is a typical cystoscopic appearance by which the diagnosis can be made if the examination is made at a certain time.

6. The prognosis as to life, on the whole, is good in women. In severe cases permanent injury to the urinary function will result.

7. The prognosis in men is good if the membrane is removed.

8. Operative treatment is always indicated in men, occasionally so in women.

9. The lesion is a rare one.

10. The careful study of any further cases is to be desired.

In conclusion I wish to thank Dr. W. F. Whitney. Curator of the Warren Museum, for permission to use the Museum's specimens from which the accompanying photographs were made.

REFERENCES

1. WILLIS. Dissertatio de Urinis, 1650.
2. TULPIUS. Observ. Med. Lugduni Batavorum, 1716 (Haultain's table).
3. FOUNTAINE. Catarrhe de la Vessie, Thesis, Paris, 1815.
4. LUSHKA. Virchow's Arch., 1854, p. 30.
5. BAUER. Med. Corresp. Bl. d. Wurtemb. arztl. Ver. Stuttgart, 1853, vol. xxiii.
6. LEVER. No. 51, p. 408, Guy's Hospital Reports, 1852 (Haultain's table).
7. LEE. Path. Trans., London, vol. xv, p. 136 (Haultain's table).
8. GUYON. Annal. des Mal. des Org. Genito Urinaires, July and August, 1887.
9. HAULTAIN. Reports of the Lab. of the Royal Col. of Physicians, Edinburgh, 1890, vol. xi, p. 185.
10. BALVAY. Lyon Med., lxxxvii, 1898, p. 287.
11. HARRISON. Jour. Am. Obstet. Suppl., Jan., 1882.
12. GOYON. Jour. Am. Obstet. Suppl., August, p. 464.
13. SAVOR. Wiener Klin. Woch., No. 44, 1895.
14. DOLBEAU. Tr. Prac. de la pierre dans la vessie, 1864, p. 309.
15. KEEN'S System of Surgery, vol. i, p. 313.
16. HEUBNER. Die Experimentelle Diphtherie, Leipsic, 1883.
17. MAY. Inaugural Dissertation, Glissen, 1869.
18. STOECKEL. Monatsber. f. Urol., Berlin, 1902, vii, p. 206. Monatsch. f. Geb. u. Gynak., Berlin, 1903, p. 1239.
19. KNORR. Cystoskopie und Urethroskopie beim weibe.
20. BOLDT. American Journal of Obstetrics, 1888, vol. xxi, p. 350.
21. PEPIN. Thesis, Paris, 1893.
22. PINARD AND VARNIER. Annal. de Gynecol. et d'Obstet., Feb., 1887.
23. DUHRESSEN. Arch. fur Gyne., 1898, vol. lvii, p. 113.

REPORTED CASES OF NECROSIS OF THE BLADDER

COLLECTED BY R. F. O'NEIL, M. D.

CASES OF NECROSIS OF THE BLADDER OCCURRING IN FEMALES

CASES OF NECROSIS WITHOUT EXFOLIATION

1. RASCH. Trans. Obstet. Soc., London, 1889, xxxi, p. 129. *Cause.* Retroflexed gravid uterus with retention. No exfoliation. Bladder wall black and sloughing in places. *Autopsy.* Patient felt something give in abdomen while scrubbing floor, 36 hour retention followed by dribbling. Catheter drew off pint bloody urine. Patient collapsed, died few hours later.

2. GERVIS. Obstetrical Transactions, 1874, No. 16, p. 233. *Cause.* Retrodisplacement, 5 months' pregnancy. Retention. Passed no membrane. No autopsy. Age 33. Two weeks previously retention, since dribbling. Poor condition. Bladder above umbilicus. Catheter, six pints porter colored urine. Uterus replaced. Death next day.

3. VAHLE. Inaug. Dissertation, Marburg, 1893. *Cause.* Incarcerated myoma of uterus with retention. *Autopsy.* Hæmorrhage in bladder wall with necrosis of muscular coat. Intestines adherent to bladder. Local peritonitis. Age 48. Urinary symptoms 14 days. Catheterized 8 days before entrance. Condition poor. 2900 cc. turbid urine drawn on entrance to hospital. Diagnosis of impacted fibroid was made. Death in 4 days.

NECROSIS WITH PERFORATION OR RUPTURE OF BLADDER

4. OLIVER. Lancet, 1890, vol. 1, p. 638. *Cause.* Retroposition, 5 months' pregnancy with retention. No membrane passed. *Autopsy.* Bladder ruptured fundus. Sloughing area 1½ in. square. Peritonitis. Retention with overflow bladder.

CASES OF NECROSIS WITH EXFOLIATION

5. GERVIS. Obstetrical Transactions, 1874, No. 16, p. 233. *Cause.* Retrodisplacement, 4 months' pregnancy, with retention. *Struct. of exfol. memb.* not given. Small pieces of membrane interfered greatly with catheterization. Age 36. Twelve days previously noticed urinary trouble, passed very little urine for last 3 or 4 days. Much distended bladder, urine foul and dark. Uterus replaced. Miscarriage and death next day.

6. FAVELL. Lancet, 1900, vol. 11, p. 1352. *Cause.* Labor. *Struct. of exfol. memb.* "Complete cast of bladder mucous membrane." This was a specimen shown before the Sheffield Med. Chirurg. Soc. It was passed per urethra 6 weeks after labor, no details.

7. WILLIAMS. Obstetrical Transactions, 1874, No. 16, p. 258. *Cause.* 4–5 months' pregnancy with retention. *Struct. of exfol. memb.* "Mucous membrane of bladder passed in a gangrenous condition." Death from sepsis. Bladder enormously distended by 3 days' retention. "In two days membrane was passed."

8. PLAUT. Inaug. Dissertation, Berlin, 1899. *Cause.* Extrauterine pregnancy. *Autopsy.* Bladder contained turbid urine and a completely necrotic membrane said to be mucosa. Peritonitis. General sepsis. Remains of bladder wall showed a diphtheritic membrane and an opening into the uterus. Cervix and vagina also showed a diphtheritic membrane. There was a localized collection of pus on the left. The anterior surface of rectum and posterior surface of uterus covered with black pseudomembrane with an opening into vault of vagina. There had been an operation, probably for drainage.

9. KIWISCH. Vierteljahrschrift fur Heil kunde. Prag., 1844, Zweitt. Quat., p. 37. *Cause.* 5 months' pregnancy. *Struct. of exfol. memb.* Incomplete sac passed composed of mucosa. Painful micturition. Urine dark and foul. Patient aborted ten days after passing membrane. Recovery.

10. OTIS. Boston Med. and Surg. Jour., May 17, 1883, No. 20, p. 458. *Cause.* Delayed 2d stage, postpartum retention. *Struc. of exfol. mem.* Mucous and

submucous coats. Catheterized for a week. Symptoms of acute cystitis. Sudden retention on 33d day after delivery. Membrane found protruding from urethra removed with some difficulty. Incontinence for some time. Recovery slow, but finally complete. Capacity somewhat reduced.

11. CORKHILL. Lancet, 1887, vol. 11, p. 1311. *Cause.* Retroverted uterus. Five months' with retention. *Struct. of exfol. memb.* not given. "Gray sloughing mass." Catheterized under ether 6 pts. foul urine. Miscarried. Membrane appeared at meatus 28 days after retention, was removed in pieces in several days. Recovery. "Holds urine well, which is clear."

12. HASS. Munchen Med. Woch., 1889, xxxvi, p. 401. *Cause.* Uncertain. *Struct. of exfol. memb.* Mucous and submucous coats, elastic, but no muscular fibers seen. Patient had an abortion at 3 months. Position of uterus normal. Had bladder irritation for short time before. Became much worse in spite of local treatment, and 10 days after abortion membrane appeared at meatus. Recovery with frequency.

13. LOCKHART. Montreal Med. Jour., July, 1891, vol. xx, p. 1. *Cause.* Cystitis following a long and difficult labor (?). *Struct. of exfol. memb.* Membrane passed in two pieces. Muscular coat was present. Bladder trouble dates from a difficult labor 2 years ago, 4 days of uterine inertia, this was followed by incontinence, which recovered so that patient could hold urine 3 hours during day, but not at all at night. Condition became so bad, frequency and pain, that she entered hospital, no improvement under treatment. Unsuccessful attempt to repair perineum. About 3 mos. after entrance passed two pieces membrane, after which was gradual recovery. Complete recovery in two months.

14. SOUTHAM. Med. Chron. Manchester, 1892, vol. xvii, p. 230. *Cause.* Retroversion (?). (Patient wore a pessary because of bearing down pains.) Probably infection. *Struct. of exfol. memb.* Mucous, submucous, and in places parts of the muscular coat. No mention of pregnancy, symptoms of cystitis five weeks, on entrance to hospital incontinence, foul urine. Treatment, irrigations, no improvement, patient passed membrane 4 weeks after entrance. Complete recovery in six weeks.

15. BEGOUIN. Arch. Cliniques de Bordeaux, 1892, vol. i, p. 479. *Cause.* Intravesical injection of sat. sol. of sod. chlor. *Struct. of exfol. memb.* Submucous and muscular coats. By mistake the patient injected sat. salt sol. into the bladder to produce an abortion at 5 months, immediately great pain and tenesmus which continued more or less till membranous cast was passed 30 days later. Result, almost complete incontinence. Nephritis. Pregnancy went on to seven months.

16. ORLOWSKI. Cent. f. Chir., Leipz., 1888, xv, p. 855. *Cause.* Followed a severe attack of dysentery. *Struct. of exfol. memb.* Gangrenous bladder mucosa. Girl, age 3. Attack of dysentery, improved in 8 days. Suddenly bloody foul urine, cleared up quickly, but returned in few days with retention. A small amount of foul urine with catheter, then after violent contraction of bladder a gray white slough appeared in catheter. On removal this was followed by a gush of purulent urine. Treatment, boric acid irrigation. Recovery.

17. KELLY. Kelly's Operative Gynecology, vol. i, p. 381. *Cause.* Overdistended bladder following ovariotomy. *Struct. of exfol. memb.* Portions of mucosa were cast off. Patient ran a high temperature, became insane, died in a year in an asylum from pulmonary tuberculosis.

18. RIBNIKAR (case 11). Inaugural Dissertation, Zurich, 1882. *Cause.* Retention after labor. *Struct. of exfol. memb.* *Autopsy.* Bladder gangrenous, extending into abdominal wall. Bladder mucosa separated. Age 36. Para 2, cystitis during pregnancy. Unsuccessful attempt to catheterize followed by incontinence. Death from a general sepsis in 6 weeks.

19. STOECKEL (case 1). Monatsber. Urol., Berlin, 1902, vii, p. 206. *Cause.* Retroflexed pregnant uterus. *Struct. of exfol. memb.* Membrane passed in shreds. Probably muscular coat destroyed. Patient was tamponed for bleeding during pregnancy. There was some injury to bladder as a vesicovaginal fistula resulted. This was unsuccessfully operated on. Result, incontinence.

20. STOECKEL (case 11). Monatsber. Urol., Berlin, 1902, vii, p. 206. *Cause.* Protracted labor. Forceps delivery at end of several days. *Struct. of exfol. memb.* "Complete cast of bladder." Muscular coat not injured. Five days after delivery incontinence for 4 weeks. Five weeks after delivery severe abdominal pain and gray sloughing membrane found protruding from urethra, which was removed. Frequency for a time. Complete recovery at end of one year and nine months.

21. GOTTBERG (case 1). (Werth.) Inaugural Dissertation, Kiel, 1892. *Cause.* Vaginal tumor, which proved to be bicornate uterus, with atresia and retained menstruation on left. Retention of urine. *Struct. of exfol. memb.* Large piece of membrane much disorganized, but containing elastic fibers. Three months later frequency every 15 to 30 minutes. Age 18. For 6 months urinary difficulties in connection with menstruation. Ten days before admission to hospital, complete retention, next day 2½ liters with catheter. Operated upon for hæmatometra, 200–300 cc. chocolate colored fluid removed. After operation bladder washed daily as urine was ammoniacal. 28 days after retention passed membrane.

22. GOTTBERG (case 11). (Werth.) Inaugural Dissertation, Kiel, 1892. *Cause.* Myoma of uterus, trauma, urinary retention. Membrane was a complete closed sac. Structure not given. Gray in color. Urinary salts on inside. Age 42. Symptoms of myoma. Thrown from sleigh, struck abdomen after which pain and retention, catheter could not be passed. 8 days later hæmaturia, followed by incontinence 7 weeks, urine foul. Membrane was passed, followed by 2d retention and incontinence for 14 weeks. Operation for fibroid successful. Result, day control, night incontinence.

23. VEIT (case 1). Samml. Klin. Vorts., Leipz., 1879, No. 170. *Cause.* Retroflexed pregnant uterus with retention. At autopsy large pieces of membrane (structure not given) found to have been cast off. Patient in asylum. Incontinence came on after attempt at suicide. Bladder enormously distended. The uterus had been replaced. Death from uræmia in two days.

24. VEIT (case 2). Samml. Klin. Vorts., Leipz., 1879, No. L70. *Cause.* Retroflexed pregnant uterus, 5 months' retention. Membrane passed in fragments. *Struct. of exfol. memb.* not given. Age 40. Frequent micturition, later incontinence, general condition poor. Bladder distended to umbilicus. Urine foul, 4 days after uterus had been replaced abortion. Later fragments of membrane passed. Incontinence 4 weeks. Frequency for some time. Final recovery.

25. HARTMANN. Bull. Soc. Anat. de Paris, 1888, lxiii, p. 516. *Cause.* Retroverted, gravid uterus, 4 months. (adherent) with retention. *Struct. of exfol. memb.* *Autopsy.* Membrane in bladder. Mucous membrane and part of muscular coat much altered. Patient 21, 3d pregnancy. Difficult micturition, sudden retention. Catheterized without precautions, large quantity urine. Catheterized next day, after which dribbling. 7 days later entered hospital. Large quantity foul urine drawn, urinary difficulty and retention continued. There was

an obstruction to catheterization, bladder could not be emptied. Attempt to replace uterus unsuccessful. Found adherent at autopsy. Death from septicæmia.

26. LOHLEIN. Zeitschr. f. Geburtsh. u. Gynak., 1888, xiv, 584. *Cause.* Torsion from a subserous myoma in fundus of uterus, causing change in circulation. *Struct. of exfol. memb.* *Autopsy.* A completely separated cast of bladder found with a dissecting hæmorrhage. Specimen from woman 36. Three days after operation for fibroid some incontinence. Fifth and 6th days hæmaturia. Urine foul, ammoniacal. Urine normal before operation. Partial separation was suspected because of difficulty in introducing irrigating catheter. Patient failed and died.

27. COCRAM. Med. News, 1893, vol. 63, p. 633. *Cause.* Tremendously overdistended bladder in a retroflexed, gravid uterus, 4 months. *Struct. of exfol. memb.* Entire mucous membrane of bladder, showing ureter orifices. Removed in two sections. Bladder distended to one inch of ensiform. Incontinence on exertion. Bladder emptied with catheter, urine bloody. In a week normal urination. Ten days later, T. 103. Abdominal tenderness. Tenesmus with bloody urine. Urethra was found blocked by sloughing tissue. Complete recovery.

28. ARROYO. Rev. Valenc. de Cien. Med., Valencia, 1904, vol. vi, No. 81, p. 203. *Cause.* Difficult labor with retention. *Struct. of exfol. memb.* not given. Large sloughing membrane and smaller pieces. Muscular coat probably badly damaged. Age 25. Primipara. Seen 18 days after confinement, had incontinence on motion from overflow bladder. Catheter 800 cc., foul urine. Became worse, taken to hospital 10 days later. Vesicovaginal fistula had developed which was dilated for drainage. Patient had passed pieces of tissue through fistula, which at times became blocked by membrane. One week after entrance, large piece removed. Patient was very ill with uræmic symptoms, Vesicovaginal fistula healed. There was a resulting ciactricial deformity of vagina which had been intensely inflamed and ulcerated. Recovery with incontinence. Capacity of bladder 30 cc., urethrovaginal fistula.

29. WARREN. Boston Med. and Surg. Jour., June 25, 1896. *Cause.* Dilatation of vagina for vaginismus. *Struct. of exfol. memb.* Mucous and submucous coats with some elastic fibers. Complete cast. Patient had had bladder symptoms for 6 months previous to operation. After leaving the hospital in 2 weeks, cystitis, much worse, 2 weeks later urine foul, alk. alb. blood, pus. Five days later symptoms of obstruction, foreign body protruding from meatus. There was moderate retroflexion. Complete recovery in about 2 years. 16 years later perfectly normal.

30. PRAEGER. Munch. Med. Woch., 1906, liii, p. 1275. *Cause.* Incarcerated uterus about 3 months. *Struct. of exfol. memb.* "Necrotic portion of bladder membrane." Patient miscarried, was curetted, bladder symptoms followed, passed calculi, had foul urine and incontinence. Digital exploration of bladder, many flat stones removed and a loose floating mass felt which on removal proved to be necrotic bladder membrane. Bladder capacity reduced. Incontinence at last note, 6 months after.

31. NORRIS. Am. Medicine, 1906, vol. xi, p. 478. *Cause.* Colon bacillus cystitis. *Struct. of exfol. memb.* "Cast of bladder." Age 32. No pregnancy, no retention. Symptoms of cystitis 8 weeks. Cystoscopy showed acute cystitis. Urine alk., cloudy. Colon bacillus pure culture. Improved in 2 weeks. Allowed to go home, to return for treatment, failed to do so. Returned in a week with a 14 hour retention and a sloughing mass protruding 4 inches out of meatus, which upon removal proved to be a cast of the bladder. Recovery.

32. ROBINSON. Albany Med. Annals, 1907, xxviii, p. 175. *Cause.* Cystitis(?). *Struct. of exfol. memb.* A flat piece of tissue consisting of epithelial elements only. Age 40. No pregnancy. Two previous attacks of cystitis. Recovery rapid under local treatment. Complete recovery.

33. O'NEIL. (case 1). *Cause.* Long, hard forceps delivery. Post-partum retention. *Struct. of exfol. memb.* "A large gray white spongy membrane." Patient had to be catheterized after delivery, symptoms of cystitis, two weeks after delivery dysuria and straining, something was noticed at meatus by nurse, next day yellow mass was larger. Expelled en masse on 3d day. Two years later, bladder capacity 2–3 oz. Incontinence on exertion. Improved under treatment. Capacity now 4 oz.

34. O'NEIL (case 2). *Cause.* Difficult forceps delivery. Post-partum retention. *Struct. of exfol. memb.* "Large sloughing membrane, size of the palm of the hand." Patient had to be catheterized for 3 days after delivery, this was followed by symptoms of cystitis and incontinence with foul urine. Three weeks after delivery sudden retention, a yellow sloughing mass was found protruding from meatus, removed by her physician. Nine months later, bladder capacity 3 oz. Can hold urine an hour sometimes, at times incontinence.

CASES OF EXFOLIATION OCCURRING IN MALES

1. BOSC. Bull. de la Soc. Anat. de Paris, 1827, vol. ii, p. 84. *Cause.* Retention. *Struct. of exfol. memb.* Thickened mucous membrane, found at autopsy almost detached. Age 72. Stricture, perineal fistulæ, intermittent retention, all urine passed by perineum. Three bladder perforations at autopsy.

2. BUCHANON. Brit. Med. Jour., Nov. 4, 1871, vol. xi, p. 520. *Cause.* Chronic cystitis. Prostate with infection (?). *Struct. of exfol. memb.* Said to have been mucous membrane entire. Recovery. Remarkable in that membrane was passed after great pain per urethra.

3. JACOBI. N. Y. Med. Jour., Sept., 1882, p. 304. *Cause.* Urinary symptoms of long duration. *Struct. of exfol. memb.* Mucous membrane found at autopsy entirely detached and filled with purulent urine. Age 66. Died with symptoms of septic cystitis. Bladder could not be emptied either by catheter or by aspiration.

4. SHRADY. N. Y. Med. Record, 1884, xxv, p. 79. *Cause.* Retention with extravasation. *Struct. of exfol. memb.* So necrotic examination negative. Membrane was passed through perineal section wound one month later. Urine had been foul. Dr. Shrady thinks it was an exudate. History, however, and length of time is very suggestive of exfoliation. Perfect recovery.

5. CLARKE. Trans. Path. Soc., London, 1888, vol. xxxix, p. 164. *Cause.* Retention three days. *Struct. of exfol. memb.* Autopsy. Partially detached mucous membrane in bladder. Top of bladder had sloughed through. Age 36. Bladder beyond umbilicus. Catheter passed. Bladder completely paralyzed. Perineal section, death from sepsis.

6. SOUTHAM. Med. Chron., Manchester, 1892, xvii, p. 230. *Cause.* Retention due to fracture 7th cerv. vert. *Struct. of exfol. memb.* *Autopsy.* A membrane consisting of mucous and submucous coats. Muscular coat was exposed on removal of membrane. Urine became

foul on 4th day in spite of precautions. Death in one month.

7. FENWICK. Tr. Med. Soc., London, 1893–4, xvii, p. 346. *Cause.* Bladder symptoms 25 years. No prostate, no stricture. Bacterial cystitis (?). *Struct. of exfol. memb.* Mucous membrane with muscular fibers on outside. Condition was found by exploratory perineal section for purulent cystitis. Recovery. Urinations every 1½ hours.

8. STEIN. Jour. Cut. and G. U. Diseases, N. Y., 1894, xii, p. 273. *Cause.* Probably lithiasis and infection. *Struct. of exfol. memb.* Portions of mucous and submucous coats had been passed by urethra. Death. No autopsy. Patient had had renal and vesical calculus.

9. DEAN. Practitioner, London, 1904, lxxii, p. 907. *Cause.* Retention two days, impacted ureteral calculus. *Struct. of exfol. memb.* Mucous, submucous, and muscular coats found at suprapubic operation. Stone removed from urethra, difficulty of emptying bladder continued for several days even with catheter. Patient passed on 3d day 95 oz. urine. Later showed signs of sepsis 18 days after retention, suprapubic operation, complete cast of bladder removed. Recovery. Capacity 5 ounces.

10. ESAU. Folia Urologica, 1907, p. 582. *Cause.* Post-operative retention. (Lap. for stenosis of pylorus in a prostatic.) Cystitis lighted up by use of catheter. *Struct. of exfol. memb.* So necrotic elements not made out. Cast of bladder including trigone and portion of one ureter. Difficulty of mic. before operation. Catheterized six days later, violent pain and tenesmus, urine foul. Constant drainage attempted, catheter continually being blocked by dirty gray looking tissue, on removing catheter piece of tissue found adherent. Ineffectual and painful attempts to empty overdistended bladder. Suprapubic cystotomy (lumbar anæsthesia). Necrotic cast of bladder removed. Recovery. Bladder capacity 100 cc.

11. DOLBEAU. Tr. Prac. de la pierre dans la vessie, p. 309, 1964. *Cause.* Vesical calculus. *Struct. of exfol. memb.* Fragment size 5 franc piece containing muscle fibers. 26 days after operation passed a membrane incrusted on one side. 39 days after operation almost all urine passed by perineum. Recovery.

12. DESCHAMPS (quoted by Dolbeau). Tr. Prac. de la dans la vessie, p. 312. *Cause.* Vesical calculus. *Struct. of exfol. memb.* "Considerable portion of internal lining of bladder." Stone was a large one. Urine became foul. Membrane was passed 37 days after operation. (By perineum?) Recovery with considerable loss of control.

13. FALKENBERG. Trans. Surg. Soc., Moscow, 1890, vol. ix, book 5, p. 378. *Cause.* Retention with extravasation. *Struct. of exfol. memb.* Membrane "looked like bladder." Recovery. Retention with sloughing of tissues of perineum, this area was drained and appeared to connect with the bladder, pus and foul urine obtained. On 19th day membrane was passed. No pathological examination, but probably true case. Perineal fistula, capacity 3 oz.

14. MARGULIES. Khirurgia, Moscow, 1904, vol. xv, p. 158. *Cause.* Retention(?). Infection. "Blood-vessels of submucous coat filled with lime salts. Probably of secondary origin." *Struct. of exfol. memb.* Mucous, submucous, and muscular coats. Removed at suprapubic operation. Patient went to bed well, awoke with tremendous desire to micturate, unable to do so at first, later passed urine and blood, after which tenesmus and passage of blood every few minutes, this continued 24 hours. After 6 days entered hospital, gradually improved. 8th day after admission a second similar attack and in 6 days more a third. Urine had become foul with cadaveric odor. Intense cystitis, catheterization unsuccessful. Suprapubic operation. Complete recovery. (This case is very completely reported, see text.)

15. SPECIMEN NO. 4968 WARREN MUSEUM. Warren Museum, Harvard Med. School. *Struct. of exfol. memb. Autopsy.* Bladder wall thickened and trabeculated; mucous membrane, hæmorrhagic and gangrenous. On left is a large diverticulum containing a slough of its entire mucous membrane. Patient 35 years old, had had a foul cystitis for 6 months. Urine, blood, pus, and gangrenous detritus. Suprapubic operation for drainage. Death in a few hours.

16. TRONCHET. Med. Jour. Bordeaux, No. 23, 1884. *Cause.* Retention in a diabetic. *Struct. of exfol. memb. Autopsy.* Bladder enlarged, color dark, tissue friable. Surface covered with a soft, gangrenous looking membrane. Age 75. Polyuria, sugar present. Patient had stricture which contracted. Retention, difficulty in passing any instrument. In 6 days condition became grave. Death.

17. PEPIN. Thesis, Paris, 1893. *Cause.* Retention due to traumatic rupture of urethra. *Struct. of exfol. memb.* Autopsy. Fragments of membrane containing submucosa and part of muscularis. Bladder gangrenous with several perforations. Adhesions to abdominal wall, omentum, and intestines. Age 57. Traumatic rupture of the urethra, hæmaturia, and difficult micturition, followed by retention and perineal urinary abscess. This was opened, one liter of foul urine, retention continued; catheterization difficult; stream was continually blocked. Abdominal wall shows signs of infection. 48 days after injury and a month after opening abscess suprapubic operation was done; abdominal wall gangrenous, large pieces of membrane were washed out. Death in a week.

18. HAGNER. Read at the meeting of the Am. Urological Association, Atlantic City, June, 1909. Am. Urolog. Assoc. Trans., 1909. *Cause.* Enormous retention in a prostatic, infection. *Struct. of exfol. memb.* Large fragments of gangrenous mucous membrane passed after perineal section. Age 72. 5 years of urinary difficulty. Dribbling became constant. Acute retention relieved after 36 hours, 4 quarts urine drawn. In 24 hours, a second retention, this time urine foul. One week after first retention perineal section under cocaine; one week later perineal prostatectomy. Recovery.

CASES OF NECROSIS OF THE BLADDER

COLLECTED BY DR. F. W. N. HAULTAIN

(Reprinted from the Laboratory Reports of the Royal College of Physicians, Edinburgh, Vol. II, 1890, p. 216.)

CASES OF NECROSIS WITHOUT EXFOLIATION

1. DRAY. Med. and Phys. Journal, 1860, p. 456. Cause of death, peritonitis.

2. HAULTAIN. Case 2. (See reference at head of table.) Cause of death, uremia.

3. BAMBERGER. Thesis (prix Capuron), by Elleaume, Paris, 1860, p. 64. Cause of death, uremia. (?)

CASES OF NECROSIS OF BLADDER WITH PERFORATION

4. VAN DOEVEREN. Observat. Acad. Groningæ, 1765, p. 83. Perforation on 23d day.

5. HUNTER. Med. Observat. and Enquires, 1771, vol. iv, p. 58. Cause of death, perforation on 6th day.
6. LYNNE. Med. Observat. and Enquiries, 1771, vol. iv, p. 388. Cause of death, perforation on 15th day.
7. NAUMBURG. Stark's Archiv, 1796, vol. vi, p. 381. Cause of death, perforation on 28th day.
8. SAXTORPH. Gesammelte Abhandlungen, 1803, vol. i, p. 261. Cause of death, perforation on 21st day.
9. MOREAU. Archiv für Gynækologie, bd. xvi, p. 341. Cause of death, perforation on 50th day.
10. LITZMANN. Archiv für Gynækologie, bd. xvi, p. 341. Cause of death, perforation on 50th day.
11. SOUTHEY. Lancet, 1871, vol. i, p. 610. Cause of death, perforation on 18th day.
12. SCHWARZ. Centralblatt für Gynækologie, 1880, vol. vi. Cause of death, perforation on 37th day.
13. CRANINX. Traite pratique des Accouchements, 1838, p. 230. Cause of death, perforation in about 1 month.
14. VALENTA. Memorabilien, 1883. Cause of death, perforation on 15th day.

CASES WITH EXFOLIATION

15. TULPIUS. Observ. Medicæ, Lugduni Batavorum, 1716. Recovery.
16. MARTYN. Path. Trans., London, 1863, vol. xv, p. 137. Recovery.
17. WELLS. Path. Trans., London, 1863, vol. xv, p. 140. Death.
18. WELLS. Path. Trans., London, 1863, vol. xv, p. 140. Recovery.
19. WHITEHEAD. Brit. Med. Jour., vol. ii, 1871, p. 432. Recovery.
20. GODSON. Brit. Med. Jour., vol. ii, 1871, p. 432. Recovery.
21. BARNES. Med. Times, vol. i, 1861, p. 186. Recovery.
22. PHILLIPS. Brit. Med. Jour., 1871. Recovery.
23. WARDELL. Brit. Med. Jour., 1871. Recovery.
24. SCHATZ. Archiv für Gynækologie, vol. i, p. 469. Death.
25. MOLDENHAUER. Archiv für Gynækologie, vol. vi, p. 108. Death.
26. FRANKENHAUSER.* Archiv für Gynækologie, vol. vi, p. 77. Recovery.
27. LUSCHKA. Virchow's Archiv, 1854, p. 30. Death.
28. BRANDEIS. Archiv für Gynækologie, vol. vii. Recovery.
29. BELL. Edin. Med. Jour., 1875. Recovery.
30. MAUNDER. Med. Times and Gazette, vol. ii, 1863, p. 522. Recovery.
31. ZEITFUCHS. Siebold's J. für Geburtshulfe, 1833. Recovery.
32. WITTICH. Neue Zeitschrift für Geburt., vol. xxiii, p. 98, 1847. Recovery.
33. HAUSSMANN. Monatschrift für Geburt. 1868, vol. xxxi, p. 132. Recovery.
34. MADUROWICZ. Wiener med. Wochenschrift, 1877, Nos. 2 and 3. Recovery.
35. HURRY. Edin. Med. Jour., 1884, p. 1000. Recovery.
36. HEWITT. Obstet. Trans., London, 1883. Recovery.
37. AVELING. Obstet. Trans., London, 1883. Recovery.
38. PINARD. Annales de Gynecol. et d'Obstet., 1886. Death.
39. BOLDT. Am. Jour. of Obstetrics, 1888. Death.
40. HAULTAIN. Case 1. (See reference at head of table.) Recovery.
41. WALTERS. Obstet. Trans. Recovery.
42. BAYNHAM. Edin. Med. and Sur. Jour., 1830, vol. xxxiii, p. 156. Recovery.
43. LEVER. Guy's Hospital Rep., 1852. Recovery.
44. University College Spec. Museum University College, Spec. 1466. Recovery.
45. MAUER. Thesis, Berlin, 1881. Recovery.
46. DORAN. Obstet. Trans., London, 1881. Recovery.
47. RITTER. Vierteljahrschrift für Heilkunde, Prague, 1844, p. 37. Recovery.
48. KLEIM. Inaugural Dissertation, Berlin, 1880. Death.
49. LEMAIRE. Bull. Soc. Anatomique, 1863, p. 416. Death.
50. DUBARD. Bull. Soc. Anatomique, 1877, p. 291. Death.
51. ROSENPLANTER. Inaug. Dissertation, Dorpat, 1856. Recovery.
52. MAY. Inaug. Dissertation, Giessen, 1862. Death.

CASES WITH EXFOLIATION AND PERFORATION

53. KRUKENBERG. Archiv für Gynækologie, 1882, vol. xix. Death.

CASES OF NECROSIS OF THE BLADDER WITH EXFOLIATION IN MALES

54. LEE. Path. Trans., vol. xv, p. 136. Death.
55. WILKS. Path. Trans., London, vol. xv, p. 138, 1863. Death.
56. LISTON. Spec. 1933, Surgeons' Museum, London. Death.

* This case is reported again together with another case (see the writer's table No. 18) by Ribnikar in an Inaugural Dissertation, Zurich, 1882. It is remarkable in that the exfoliated membrane showed the presence of peritoneum.

DEPARTMENT OF TECHNIQUE

THE VALUE OF A SILK THREAD AS A GUIDE IN ESOPHAGEAL TECHNIQUE

By H. S. PLUMMER, M. D., Rochester, Minnesota
Physician to St. Mary's Hospital

IN a paper read before the New York Academy of Medicine in 1903, Dunham[1] presented a method of dilating cicatricial stenosis of the esophagus, which consisted in picking up a previously swallowed silk thread through a gastrostomy opening, and of using this thread to draw spindle-shaped sounds down through the stricture. While using Dunham's technique, Mixter[2] conceived the idea of using a silk thread, which had passed through the stomach into the intestine sufficiently far to permit of its being drawn taut as a guide for passing dilating sounds, thus, in most instances, doing away with the necessity of a gastrostomy.

The work of Mixter and Dunham has not attracted the attention which it deserves, comparatively few physicians being acquainted with this technique.

It is the purpose of this paper to again call attention to the value of a silk thread as a guide in dilating cicatricial stenosis and to report the more general use which I have made of it during the last five years in the study of about 300 lesions involving the esophagus. This group of cases includes 100 carcinomata, 65 diffuse dilatations associated with cardiospasm, 8 cicatricial stenoses at the cardia, and 7 diverticula.

In an attempt to develop a safe and systematic technique for the diagnosis and treatment of esophageal diseases, the silk thread in conjunction with skiagraphy, esophagoscopy, and the passing of sounds has proved of pre-eminent value. A complete exposition of the value of the silk thread in esophageal technique would necessitate a more lengthy discussion of the methods at our command than the limit of this paper will permit.

The patient slowly swallows six yards of buttonhole twist. This passes down through a sufficient number of coils of intestine to prevent its withdrawal on being pulled taut. It is advisable to have the patient swallow three yards during an afternoon, and the remaining three yards on the following day. The first portion forms a snarl in the esophagus or stomach, which passes out into the intestine during the night; the remaining portion follows, as a rule, without snarling. When the co-operation of the patient is wanting, as in infants, the thread can often be washed down through a stomach tube. I have met with but one failure to pass a thread through a cicatricial stenosis, though in a few cases much patient persistence was necessary. In my work the thread has been introduced over five hundred times, and not in a single instance has a symptom come up which would arouse the suspicion of harm from its presence in the intestinal canal. Not rarely, the thread will pass entirely through the gastrointestinal tract. A number of times, a heavy braided silk thread has been left in place for weeks. The olives are drilled from the tip to one side of the base for threading (Fig. 3).

In the introduction of esophageal instruments the thread has made possible adherence to the following rules:

1. The tip of the instrument must be constantly under the guidance of vision, or,

2. The instrument must follow a guide in such a way as to make perforation of the esophageal wall with its tip impossible.

The force required in introducing esophageal instruments is expended in overcoming the friction of the shaft on the walls of the passage, or it is dissipated at the tip of the instrument. A clear conception of the way in which the force is expended in the advancement of an esophageal instrument is essential to its safe introduction. While the element of friction is an important factor in the introduction of rigid staffs like the esophagoscope, it may for the present be disregarded. Under the term pocketing, for convenience, may be included all forms of obstruction to the introduction of a flexible sound other than that encountered when dilating a stenosed portion of the canal. Without going into the reasons, it

[1] Dunham. Vol. xxxvii, 1903, p. 350.
[2] Transactions of American Laryngological Society, 1909.

is sufficient for the present purpose to state that an unguided sound will, as a rule, be pocketed if an opportunity is present. When introduced on a taut thread, a sound follows the axis of the lumen of the esophagus. By varying the tension on the thread, obstruction from pocketing, and obstruction the result of actual narrowing of the canal may be distinguished. The elimination of pocketing permits a more accurate determination of the diameter of the lumen, and of the rigidity of the esophageal wall at the seat of narrowing. The thread avoids all prolonged searching with a sound and the rapidity and certainty with which the sound can be passed through the mouth, pharynx, and esophagus very much facilitates the management of children and nervous adults. Inability to differentiate obstruction from narrowing, and obstruction from pocketing, is responsible for the greater part of the reported mortality of from 10 to 15 per cent from perforation in cases of cicatricial stenosis, and the not infrequent deaths (not often reported) in cases of carcinoma and other esophageal lesions following the usual method of passing sounds.

Hardly more than an appreciable degree of force is permissible in advancing an unguided esophageal sound. With a silk thread that degree of force may be used which is short of carrying the thread out of its course through the esophageal wall, or of endangering the esophagus by longitudinal traction, or of splitting the esophagus by a dilating wedge. If sufficient obstruction is encountered to make it seem possible that the thread might be carried out of its course, a piano wire should first be passed on a thread, and the olive passed on the wire. The abruptness of the turns of a tortuous esophagus determines the size of wire which will most readily pass (No. 6 to 14 piano wire). With the wire in place the possibility of introducing the sound is assured. When passing an olive on the wire, tension on the thread should be maintained to avoid any possibility of the tip of the wire penetrating the wall of the stomach or esophagus.

In the treatment of cicatricial stenosis the wire guide is not often necessary after the first dilatation, and the thread may be dispensed with as soon as the smaller sizes of spindles will pass without encountering obstruction at the site of the stricture. Further dilatation is carried out with the sound shown in Fig. 4; the flexible spiral metal tip acts as a guide, and the stricture is dilated with the olive inserted in the staff. In those dense, extensive strictures in which sufficient dilatation cannot be obtained by dilating with a spindle, I resort to a modification of Dunham's esophagotome, which utilizes Dr. Abbe's principle of cutting partially through the distended stricture by a string pulled back and forth.

The marked distortion and dilatation (the result of traction and the strong propulsive force of the muscles of deglutition) in lesions of the upper three inches of the esophagus often renders the introduction of the sound or esophagoscope difficult. The thread entirely obviates pocketing of the sound and occasionally facilitates the introduction of the esophagoscope by guiding a flexible mandrin.

The conditions present in lesions at the cardia will be considered a little more in detail as they particularly well illustrate the service of the silk thread.

The thoracic portion of the esophagus is placed nearly in the median line, but deviates to the left as it passes forward to the opening in the diaphragm. In the dilatation of the esophagus accompanying spasmodic or organic stricture at or near the diaphragm, the right wall of the esophagus is displaced to the right, while there is relatively little displacement of the left wall to the left. As a result of this displacement the right posterior wall of the lower portion of the esophagus approaches a horizontal plane, or even dips below the level of the cardia. This is well illustrated in Figs. 1 and 2, radiographs taken in cases of diffuse dilatation of the esophagus. In passing an olive through the lower three inches of a normal esophagus, the staff impinges on the left anterior wall, and the olive is directed to the cardia by the left posterior wall. This portion of the esophageal wall presents an increasing degree of obstruction as it approaches a horizontal plane in cases of diffuse dilatation. The degree of obstruction encountered depends also on the stiffness of the staff, the size of the olive, and the tonicity of the esophageal wall. A stiff staff has a tendency to penetrate the esophageal wall (Fig. 5 A), while a relatively flexible staff conforms to the right posterior wall, and the olive approaches the opening in the diaphragm as shown in Fig. 5 B, that is, at an angle with the axis of this portion of the esophagus. In 35 cases of cardiospasm, a 15 mm. olive was passed without a guide, frequently without being able to locate the cardia. In 30 cases it was impossible to pass the cardia with a degree of force which the author considered safe. In but 5 cases was marked obstruction to the passage of an olive on a thread encountered. The facility with which an olive may be passed through the cardia in these cases depends more upon the access than upon the size of the lumen of the canal. This is illustrated by the difficulty experienced in

Fig. 1.

Fig. 2.

attempting to pass a proctoscope in an axis other than that at right angles to the sphincter muscle.

In addition to the points brought out above, the rigidity of the esophageal wall and the ledge (Fig. 6), formed by the upper margin of the growth, are important factors in passing a sound through a carcinomatous cardia. Crowding a sound over the ledge and through a cardia, the lumen of which is much larger than the olive, may give the impression of having passed a narrow stricture. The thread, by eliminating pocketing, permits of a more accurate determination of the diameter of the lumen, and of the rigidity of the esophageal wall at the seat of narrowing. The thread makes the dilatation of a carcinoma of the esophagus reasonably safe. No matter how much care is exercised, the attempt to pass an unguided sound through a carcinomatous stricture is apt to result in perforation. The usual seat of the perforation is at the juncture of the upper margin of the growth and the uninvolved esophageal wall.

There is a group of cases of carcinoma of the stomach in which obstruction to the passage of a sound is met just below the cardia. We have been able to make a comparatively early diagnosis of carcinoma in a number of these cases by the impression created when passing a sound on a thread. The sound is introduced until the obstruction is encountered, the tension on the thread is then varied so as to advance the sound along the upper surface of the obstructing mass. For this procedure a very small, flexible, whalebone staff and 15 mm. olive is used.

The conditions present in cicatricial stenosis at the cardia or the diaphragm level, make the introduction of a sound particularly difficult and hazard-

Fig. 3.

Fig. 4.

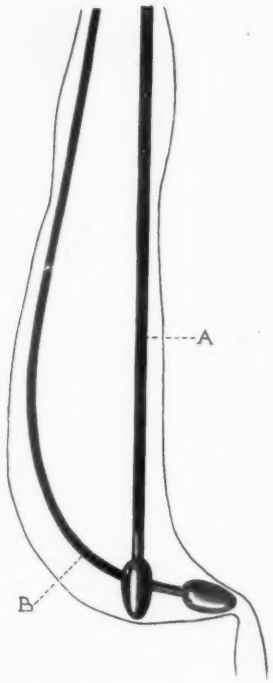


Fig. 5.

Fig. 6.

ous. The narrow tortuous lumen of the stricture lies at an angle with the right posterior wall of the dilated esophagus above, and the small sounds necessary to pass the stricture do not lessen the danger of perforation.

In a series of eight cases of cicatricial stenosis of the cardia, the result of simple ulcers or syphilis, the introduction of a sound was impossible. In three cases, after attempting to pass a very small sound on a thread, a wire guide was deemed necessary. It may be of interest to note that in these cases the sound was passed on the thread or wire through the esophagoscope.

My method of diagnosticating diverticula of the esophagus makes their recognition easy and, in some cases, gives information not easily obtained in any other way. The subjective symptoms in deepseated diverticula and cardiospastic dilatation of the esophagus are very similar and may be identical in some cases. The fundus of a deepseated diverticulum rests on or near the diaphragm, and a sound is obstructed at the same distance from the teeth as in diffuse dilatation. In either condition the sound, if repeatedly advanced and withdrawn, or inserted on different occasions, may at one time meet obstruction at the diaphragm level and at another time enter the stomach without giving any aid in the differential diagnosis.

As the neck of a diverticulum almost invariably lies in an axis with the upper portion of the esophagus, a sound will enter the diverticulum when introduced on a loose thread. When introduced on a taut thread, the sound readily enters the stomach. By first introducing the sound into the diverticulum until it is obstructed (Fig. 7) and then drawing the thread taut, the sound will be lifted out of the esophagus sufficiently far to bring the olive to a level with the opening into the distal portion of the esophagus. Until this point is reached, the sound cannot be advanced without relaxing the thread. With the olive at the level

of the opening into the esophagus (Fig. 8), and the thread drawn taut, the sound can be advanced into the stomach. This method of procedure is sufficient to demonstrate the existence of a diverticulum, to locate its point of origin and more dependent portion. Rumpel's test, or any of its modifications may be carried out in a similar manner with the added definite knowledge of the location of the point of the tube, and a certainty that it will enter the stomach.

Occasionally the thread is of value in following the course of a tortuous esophagus with the esophagoscope. To the experienced operator this is not of much advantage except in cases of congenital malformation, and in locating the slit-like opening into the distal portion of the esophagus in cases of diverticula. The thread is drawn up through the esophagoscope before its introduction. When drawn taut, the thread impinges on that margin of the distal opening of the esophagoscope toward the lumen of the esophagus. In direct gastroscopy, orientation is much facilitated in a similar way. The thread leads to the pylorus, and enables the operator to quickly place the relation of any portion of the stomach to that orifice. In mentioning this I do not wish to be interpreted as advocating gastroscopy in its present state of development.

The thread enables one to quickly and accurately place the hydrostatic dilator in cases of cardiospasm.

The forced feeding by means of a stomach tube introduced on a thread made possible a successful operation on a previously much emaciated case of diverticulum. The method has also proved of value in the study of stomach lesions associated with esophageal stenosis.

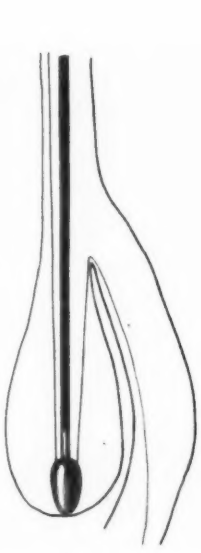


Fig. 7.

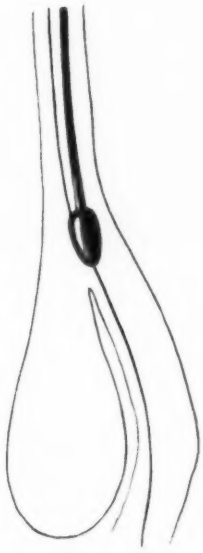


Fig. 8.

In a number of cases we have demonstrated the possibility of introducing stomach tubes, sounds, and even the hydrostatic dilator through the stomach into the duodenum. That this technique will ever find an important place in the study of the pylorus, duodenum, and pancreas is doubtful.

REMOVAL OF FOREIGN BODIES FROM THE BRONCHI

Gilt Upholstery Nail (No. 43) Removed from the Right Bronchus ("Low Tracheotomy and X-ray")

By FRANCIS HUBER, M. D., New York City, New York

Professor of Clinical Medicine, College of Physicians and Surgeons, Medical Department of Columbia University, New York; Visiting Physician Gouverneur Hospital; Attending Physician Beth Israel Hospital (Children's Ward)

Jacob M., nine years of age, nativity Russia, was admitted to the children's service, Beth Israel Hospital, February 22, 1910. Family history, negative. Personal history, surroundings poor. Diet, mixed. Bowels, regular. Urination, normal. With the exception of measles as a child, he had enjoyed fair health up to the present illness.

On February 21st, accompanied by his father, he presented himself for examination and admission to the hospital. He looked pale, worn with anxious expression, and somewhat emaciated. Questioning the father and the patient, the following rather indefinite history was elicited: For the past five weeks the boy had gradually lost flesh and strength. He suffered from fits of coughing attended with muco-purulent expectorations. There was occasional vomiting with the cough. No night sweats or hæmorrhage, not even a trace of blood in the sputum. Occasionally he complained of chilly feelings, but no fever, with the exception of three or four days, two days after the onset of his illness.

Appetite poor, pulse and temperature normal, physical examination revealed retraction of the infraclavicular region on the right side with diminished expansion. The right anterior aspect of the chest in fact is flattened. The deformity is of long standing, the result of rickets and nasal obstruction. On percussion marked dullness over second, third, and fourth interspaces anteriorly, apex not involved. The breathing was diminished and on deep inspiration fine rales were heard over the dull area.

In view of the indefinite character of the history and the physical findings, Dr. Ginsburg, senior house physician and "Admitting" on that day, deemed it advisable to have the sputum examined for tubercle bacilli, and an X-ray examination made. The latter was in accordance with the rule established in the children's service, viz.: To have flouroscopic examinations made in all chest cases with *anomalous signs*.

The X-ray revealed a marked infiltration of the right upper lobe; in the midst of the inflamed area, apparently lodged in the right primary bronchus, a tack, three-quarters of an inch long, was detected.

In the light of these findings, a careful questioning elicited the following points: Five weeks before admission, the child accidentally swallowed a brass tack. Almost immediately he was taken with a severe coughing spell, which lasted for several minutes, the attack was not attended, however, with any evidence of asphyxia. The cough recurred at frequent intervals, the expectoration was muco-purulent, but at no time was there any streaking with blood. Two or three days after the accident, he developed a high temperature — 105—with dyspnœa and prostration. The marked constitutional symptoms subsided in about one week. The cough and malaise continued, in consequence the patient passed most of the time in bed. The appetite became impaired and bowels were constipated. No chills or sweats. He vomited a number of times, generally after coughing, occasionally after food or medication. Fearing punishment he had failed to tell his parents about the accident, nor did he say anything to Dr. Ginsburg, until told that a brass furniture tack was the cause of the trouble.

In reviewing the history of the case prior to the X-ray examination, we find as prominent features, a persistent cough, frequently followed by vomiting, loss of flesh and strength, with *anomalous* physical signs on the right side. Tuberculosis could be excluded because of the position and localized character of the consolidation and the absence of bacilli in the sputum. A localized empyema or unresolved pneumonia in the situation as found in our patient, must of necessity be due to some local exciting cause. In such cases the X-ray affords valuable assistance, not only as to the presence but also the exact location of a "suspected" foreign body, provided the latter throws a shadow.

In three cases personally observed, in which the object evidently was not impacted, the position of the patient would influence the symptoms in a striking and characteristic manner. Distressing cough and choking spell resulted when the patients were disturbed or placed on the unaffected side; relief was immediate when the original posture was resumed. It appears as though such children instinctively assume a position in which there is least disturbance of the foreign body.

The diagnosis of an unsuspected foreign body cannot be made at once; close observation extending over days, with a careful consideration of the symptoms and an X-ray examination, may be required. The physical signs vary at times in a deceptive manner. Thus in the case of Issie B., 3½ years of age, admitted December 31, 1908, the

Photo No. 1. X-ray picture showing tack and area of consolidated lung.

physical signs of an acute pneumonia disappeared over night. Further observation in the ward revealed frequent recurring attacks of vomiting preceded by a spasmodic cough, simulating pertussis without the "whoop." The attacks, it was further found, could be readily evoked when the patient was made to assume a certain position on the back. Breathing was feeble over the middle lobe with fine rales on deep inspiration. The first X-ray, negative. The value of repeated X-ray examination was shown by the finding of a foreign substance, probably a piece of match about one and a half inches long, in the right bronchus, in the second plate. Unfortunately operative interference was refused.

The existence of a spasmodic cough attended by vomiting is suggestive, particularly so, if the spasms recur with greater frequency on assuming a certain position.

If the foreign body be movable, paroxysms of cough and dyspnœa of varying degree, are excited with change in position. The absence of such suffocative attack and the further fact that a change in position of the child did not lead to any reflex cough, justified the inference that the "tack" was probably imbedded, a suspicion verified at the time of its removal.

In the absence of a history of the entrance of a foreign body, suspicion may be aroused by anomalous symptoms. In children in particular, with unusual thoracic symptoms, the possibility of such an accident must be kept in mind.

In two cases of abscess and gangrene of the lung, the diagnosis of foreign bodies, confirmed by X-ray examination, was made by a process of elimination of other possible etiological factors. Many other points of interest might be referred to in this connection, but are omitted as they have already been discussed in a former paper (Arch. Ped., March, 1909).

On February 26th after consultation with Drs. Felix Cohn, Wolff Freudenthal, and Henry Mann Silver, to whom I herewith extend sincere thanks for the kind assistance and co-operation, it was decided to attempt the removal by superior bronchoscopy.

Anæsthol was administered by Dr. Horowitt, house physician; Dr. Freudenthal then resorted to bronchoscopy.

Fig. 2. X-ray picture taken about one week after operation, showing improvement in pulmonary condition. Patient on back, alligator forceps and nail placed over anterior surface illustrating relative position at time of operation.

Though the bronchoscope was readily passed, the amount of muco-pus and blood stained mucus proved an obstacle to a thorough examination of the deeper parts. As it was impossible to secure a clear field with the means at hand, and as the "secretion aspirator" failed to work, superior bronchoscopy was given up.

With the kind assistance of Dr. Silver, a low tracheotomy was performed. A moderate sized goiter with a large isthmus, necessitated a low incision in the trachea. The excessive secretion of mucus and blood prevented a successful attempt at inferior bronchoscopy as practiced in a former case. Several attempts with forceps passed blindly into the trachea were then made without success. The patient was now taken to the X-ray room and placed on his back on a wooden table, with the light underneath. After the tracheotomy tube was removed, a pair of alligator forceps, bent at an angle, were introduced into the trachea, and the fluoroscopic screen was placed in contact with the anterior aspect of the chest. The rays were then turned on. The shadows of the forceps and the tack were distinctly visible on the screen. After a few attempts the object was felt and readily seized at its point. Slight traction was required to free the head from its bed, its removal was accomplished without any further difficulty, though caught and held at the tracheal incision. The light was now turned on, and the extraction completed by retracting the cut tracheal rings. As the tack was being removed, it was interesting and instructive to follow the shadow of the moving picture on the fluoroscopic screen. The time of exposure to the rays, according to Dr. Hirsch, did not exceed two minutes.

The impression made on the spectator, as one of the gentlemen present remarked, as the tack was slowly withdrawn, was that of a small fish dangling at the end of a line.

The tracheotomy tube was again inserted, narcosis was discontinued, hot, wet compresses placed over the wound, and patient put to bed. The subsequent course was uneventful. The tracheotomy tube was dispensed with after 45 hours. Voice clear, breathing good, no evidences of laryngeal or tracheal irritation noted. The pulmonary signs began to improve rapidly. Temperature flat. Wound practically healed March 10, 1910.

To our skilled radiographer, Dr. I. S. Hirsch, I freely and cheerfully acknowledge my indebtedness and obligation for his courtesy and valuable assistance.

Fig. 3. Photograph showing position of patient, screen, and light under table.

Foreign bodies have been removed from the œsophagus under the guidance of the X-rays. A few such cases are recorded in recent literature. Last October, a drainage tube escaped into the pleural cavity, in a case of empyema. After several unsuccessful attempts with the finger and forceps, its removal was readily accomplished under the guidance of the X-ray. The suggestion to adopt this plan originated with Dr. Hirsch. The facility and ease with which the rubber tube was seized and removed, induced the writer to repeat the procedure in the present case, when, because of unforeseen exigencies, bronchoscopy was impracticable.

A word of caution may not be amiss. The possible danger of explosion, if ether be employed as an anæsthetic during the examination by the X-ray, should not be forgotten.

Krukenberg (Muench. Med. Wochenschrift, Jan. 25, 1910) reports a case, which might have been more serious in its results, in which ignition of the ether vapor was caused by the spark from the X-ray machine.

Once the trachea is opened, the forceps introduced, the screen applied to the chest and the rays turned on, the rest is simple. But one instrument is used, a pair of alligator forceps bent at an angle. There is no need of wiping away secretions to clear the field, nor is it necessary to resort to cocaine or adrenalin in the trachea or bronchi. Reflex spasm is controlled by general anæsthesia. The reaction is nil, even in the presence of a septic pneumonia as in our case.

The method commends itself because of its simplicity and ease of application. The case to be reported by Dr. Robt. T. Morris demonstrates conclusively that the necessary manipulations may be carried out, not only in the main branches, but also in the secondary ramifications.

PIN REMOVED FROM ASCENDING DIVISION OF LEFT BRONCHUS WITH AID OF FLUOROSCOPIC SCREEN[1]

By ROBERT T. MORRIS, M. D. New York City, New York
Professor of Surgery at the New York Post-Graduate Medical School and Hospital

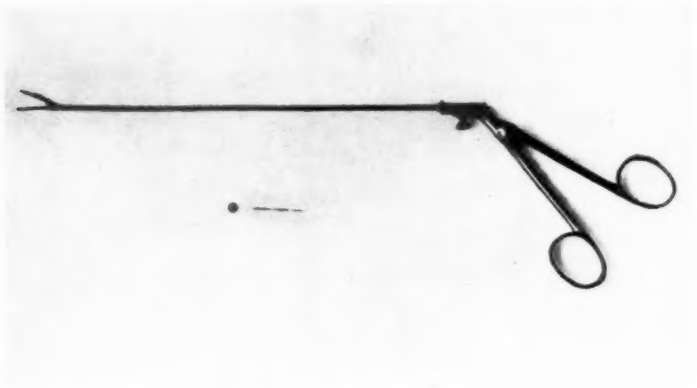
WHEN it was reported last month that Dr. Francis Huber of New York had used a fluoroscopic screen successfully as an aid in guiding forceps to an object in the bronchus, many of us no doubt awaited opportunity to verify the practicability of the procedure. The first suitable case coming under my care was sent by Dr. H. W. Fleck of Bridgeport, Conn.

Miss E. E. H., a young lady of fine physique, twenty-five years of age, five feet, five inches high and weighing one hundred and sixty pounds, had aspirated a veil pin about a month previously. The pin was of slender blued steel with an extremely sharp point, and black glass head. The patient states that immediately upon aspiration of the pin she felt it go to a point "back of the left breast," and she coughed violently and uncontrollably for an hour, until a Christian Science practitioner came to her aid, when she was able to stop the coughing. Subsequently she noted an occasional "rattling" in the vicinity of the pin, and was aware of its location. When she entered the Post-Graduate Hospital on March 11, 1910, I asked Dr. Arthur F. Chace to make a physical examination, and he reported that aside from a few localized mucous rales there was no evidence of change in the character of the tissues of the lung. Dr. Ludwig Kast examined the chest with the fluoroscopic screen, and found that the pin could be located without difficulty, the shadow lying beneath the fifth and seventh ribs as shown in the accompanying radiograph, which was made by Dr. F. H. Albee. Arrangements were made by Dr. Kast for placing the patient on her back upon a wooden table in the dark room, conveniently for conducting the operation beneath the fluoroscopic screen which was laid upon the patient's chest. On March

[1] A case reported at the Meeting of the Surgical Section of the New York Academy of Medicine, April 1, 1910.

Glass-headed veil pin in ascending division of left bronchus. Removed through a low tracheotomy incision by alligator forceps with the aid of the fluoroscopic screen. Patient returned home on fourth day. No complications.

14th the work was done. Chloroform anæsthesia was chosen in the belief that it would cause less bronchial irritation than ether, and this part of the work was assigned to Dr. I. J. Hoover of the hospital staff. One of my assistants, Dr. C. E. Hyde, asked if it would not be well to try an electro magnet. The answer was that an electro magnet would certainly have been at hand if the idea had occurred to me, but we were then about to proceed with the operation and it was too late. A low tracheotomy was performed. The trachea was exposed by using scissors opened repeatedly in situ, for the purpose of avoiding any hæmorrahge, and as close as possible to the sternal notch. The trachea having been exposed without hæmorrhage, two single hooks were inserted behind one of the rings, and the trachea brought forward and kept under control by Dr. W. S. Stucky, who had charge of the retractors throughout the operation. This proved to be an important step, and should not be forgotten by other operators, as the trachea is deeply situated at this point, and the small buttonhole through which the forceps were inserted would be obscured, if the opening in the trachea were not held close to the external incision. Dr. B. T. Davey assisted Dr. Kast in regulating the X-ray apparatus so that the screen could be used to advantage. When all was ready — the patient asleep, the tracheotomy done, and the screen placed in position on the patient's chest, I introduced through the buttonhole in the trachea, a long pair of alligator forceps of the sort commonly used with the bronchoscope. The forceps stopped first at the bifurcation of the trachea, at a distance of about three and one-half inches from the tracheal incision. Guided by the sense of touch, they were dislodged and carried into the left bronchus, through which they passed freely for about two inches. Again the forceps were arrested at a second bifurcation, and through the screen it was observed that the forceps at this point of arrest were one-third of an inch from the point of the pin, and the pin was evidently in an ascending division of the left bronchus. Quite a little manipulation was required, aided by the sense of touch, to pass this second bifurcation. The forceps then slipped ahead again for about an inch, and were seen to be alongside the pin. Dr. Kast used the diaphragm of the screen at this point for getting clear definition, and believes it to be an important feature of the work. Through the screen we could see the forceps opening and shutting upon the pin, but it did not respond to the first pull. The sharp point was evidently caught in the tissue. This was probably due to violent coughing when the pin was first aspirated, and the pin being caught at the point very likely allowed air to pass the head, so that atelectasis was avoided. Five or six times in succession the forceps slipped off from the pin, which could be felt as well as seen. Whenever



Alligator forceps and veil pin. (Case of Miss E. E. H.)

the forceps slipped off it required some little time to get gently by the bifurcation and alongside the pin again, as I felt that any considerable degree of force exerted at this point would result in puncturing the bronchus with the point of the forceps, and we would then be defeated, besides placing the patient in a position of danger. Realizing that the point of the pin must have been firmly imbedded in the tissues, I carried the whole pin a little farther into the bronchus, and then grasping it exactly by the point, withdrew it altogether without further difficulty. The pin had been at a position about six inches from the notch of the sternum, and evidently in one of the ascending divisions of the left bronchus, as indicated by the two turns necessary for getting clear of bifurcations, and also by the position of the pin, head up, as shown by the radiograph. It is probable that the bronchoscope could not have been employed successfully for a pin in this position.

It is also probable that an electro magnet would not have dislodged this particular pin, with its point already caught in the tissues, but in similar cases without lodgment of the point of an object, a long electro magnet is a resource to be thought of. The pin was slightly rusted. Its measurements were, diameter of shank of pin, one thirty-second of an inch; length over all, one and ten thirty-seconds inches; diameter of glass head, thirteen sixty-fourths of an inch. For another similar case I would have alligator forceps made without transverse serrations on the jaws. In this case the transverse serrations seemed to prevent the pin when grasped at an angle from turning freely, and swinging clear of obstructions. The small tracheal wound was not sutured. The rest of the wound in the neck was closed with a subcuticular suture of fine catgut, with the exception of a minute drainage point. It seemed best to make provision for a little drainage, because the patient had blown some bronchial mucus over the wound. The neck incision healed by primary union with moderate scar as you observe (patient exhibited). There was no reactionary inflammation of the lung of any consequence, and the patient returned to her home on the fourth day after the operation. She went under the anæsthetic smiling, came out smiling, admitted no sensation of nausea or pain, and attributed the absence of complications to her faith. The entire operation required thirty minutes. Part of this long time was consumed at the outset in waiting for coughing to subside when the forceps were first introduced into the trachea. The patient more deeply anæsthetized then stopped coughing altogether, and breathed smoothly and regularly throughout the rest of the operation. Most of the time was lost in getting the forceps past the second bifurcation each time they slipped from the pin, because of the necessity for patience in keeping all movements gentle in character.

When the bronchoscope was invented, and we were enabled to remove objects from the trachea and bronchi, a notable advance was made.

The case here presented demonstrates that with the aid of the fluoroscopic screen we can go still another step ahead, and remove objects from divisions of the bronchi. One may even conceive of cases in which objects casting no shadow may be made to become visible by impregnating them in situ with the salts of metals.

A fortunate part of the advance steps rests in the simplification of procedures, so that less and less skill is required, in the case here shown, almost no skill at all being required for removal of the pin.

SURGICAL KNOTS

By O. BORCHGREVINK, M. D., Christiania, Norway

THE efforts of modern surgery not only to diminish the operative dangers but also to reduce the importance of the operation, have created a series of technical improvements, of which the use of gloves is by no means the least. But with the gloved hand to tie a knot in the old fashion by rolling the thread between the thumb and the index finger meets with difficulty. To some men it has, therefore, seemed a necessity to look out for a new manner of tying, in which an extended thread is caught between two fingers, and slipped into the knot. In a word, a methodical tying of knots has by degrees begun to develop.

That this is a step forward is undeniable. During the tying the thread is caught in a precise way and the more or less accidental action of the fingers that occurs from lack of a definite tying technique is escaped, the tying of a "granny" knot becomes impossible. Another practical profit is, that all sorts of tying take place much more quickly.

That the cultivation of surgical tying is justifiable is scarcely to be disputed. But about the degree in which tying during an operation is desirable, opinions may differ. Some surgeons tie many knots, others make quite few. Some prefer a continued suture,others, among whom is the author, consider this in most respects inferior to the interrupted. The latter has at any rate the merit of favoring a discharge from the wound, which may be copious during the first 24 hours after the operation despite the most painstaking hæmostasis; evacuation is no doubt to be preferred to the more or less serious hæmatomata, which if there be an unsatisfactory outlet, form here and there in different depths of the wound.

But quite apart from suture it is a surgical virtue to embrace tying of knots with a certain amount of interest. The surgeon, who likes to tie knots places a ligature, where another simply removes the clips. And the hæmostasis can never become too scrupulous. Moreover it belongs to good surgical technique to tie one's knots both quickly and safely. Besides, this has an educational effect on the assistants and impresses the spectator. Not least in surgery, success depends upon detail.

The knots I here describe have been in use for many years. Some of them I have learned from others, two I have devised during my own work.

The one-handed knots are of special interest. They can be made with the left hand at the same time as the operator pulls the thread through the tissues with the needle in his other hand. Or one ligature after the other can be made with one end of a long catgut by the left hand while the coil is held in the right.

Among these the famous *Eiselsberg knot*,[1] as far as I know invented by Professor Eiselsberg of Vienna, is the most prominent.

Part i, step 1 (Fig. 1). Hold the left end of the thread between the third and fourth fingers, let the thread on its way towards the wound run across the hollow of the hand and over the back of the thumb and the index finger.

Part i, step 2 (Fig. 2). Pass the right part of the thread under the index finger, and obliquely across the pad of its tip. Pull the thread fairly tight.

Part i, step 3 (Fig. 3). Bend index finger in middle and terminal joints; the right hand part of the thread is then brought into the hollow of the hand and the back of the finger tip put under the left hand part of the thread between the thumb and middle finger.

Part i, step 4 (Fig. 4). Don't move the index

Fig. 1. Position to begin the Eiselsberg knot.

Fig. 2. Step 2 of Eiselsberg knot. The right hand part of the thread is passed under and across the index finger.

Fig. 3. Step 3 of Eiselsberg knot. The thread is brought by the index finger towards the hollow of the hand and under the other thread.

Fig. 4. Step 4 of Eiselsberg knot. The thumb grasps the left hand part of the thread on the index finger.

Fig. 5. Step 5 of Eiselsberg knot. The thumb and the index finger pull the short end of the thread through the loop and draw the knot tight.

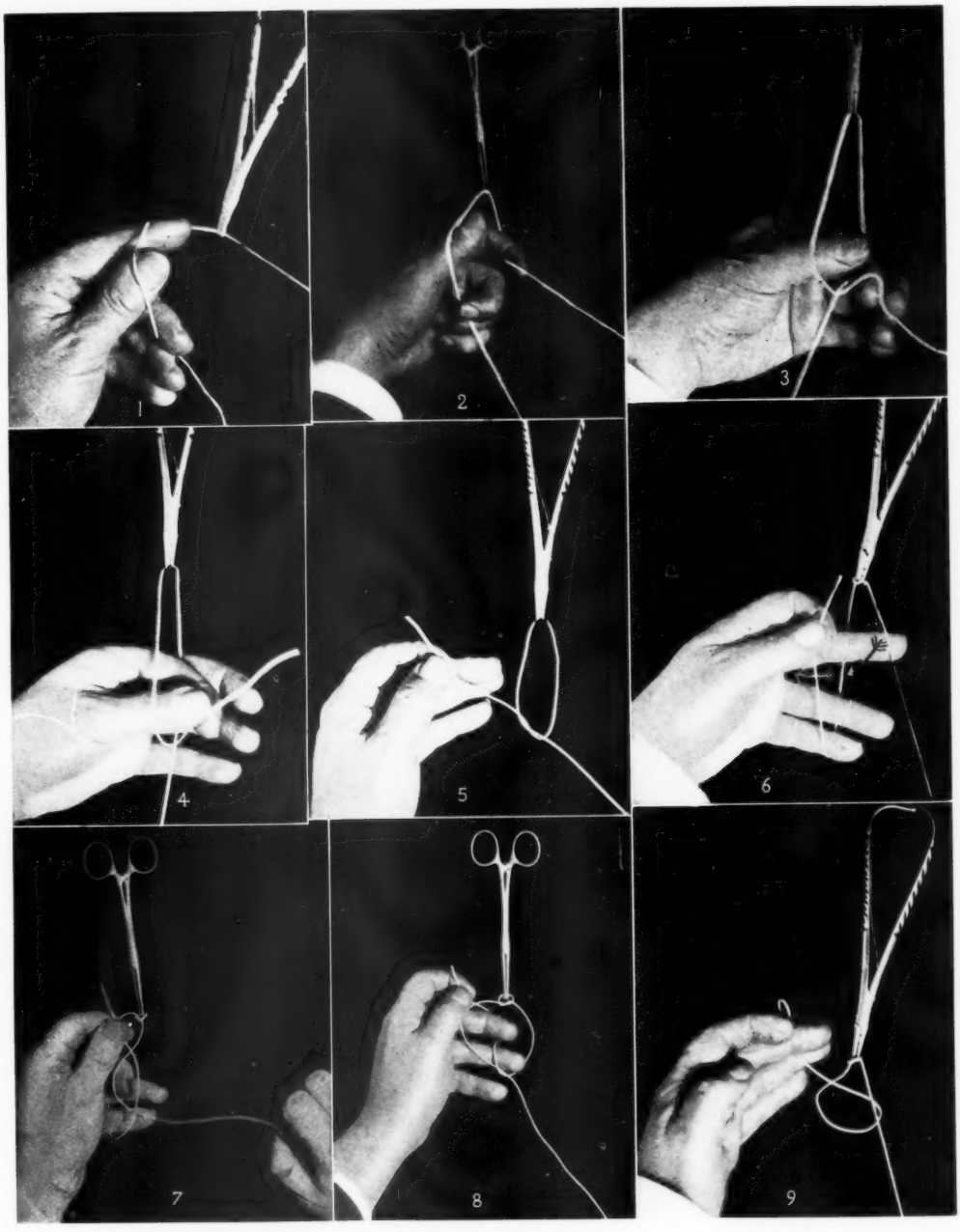
Fig. 6. Position for the beginning of part ii of Eiselsberg knot. The left hand thread runs in the figure over the little finger. It may instead run over the ring finger.

Fig. 7. Part ii, step 2, of Eiselsberg knot. Middle finger carries the long thread into the hollow of the hand past and under the short part.

Fig. 8. Part ii, step 3, of Eiselsberg knot. The short part of the thread is grasped between the middle and ring fingers.

Fig. 9. Part ii. Terminal step of Eiselsberg knot. The middle and ring fingers carry the thread through the loop and draw the second knot tight.

[1] Has been described in the Surgical Record, but without its name.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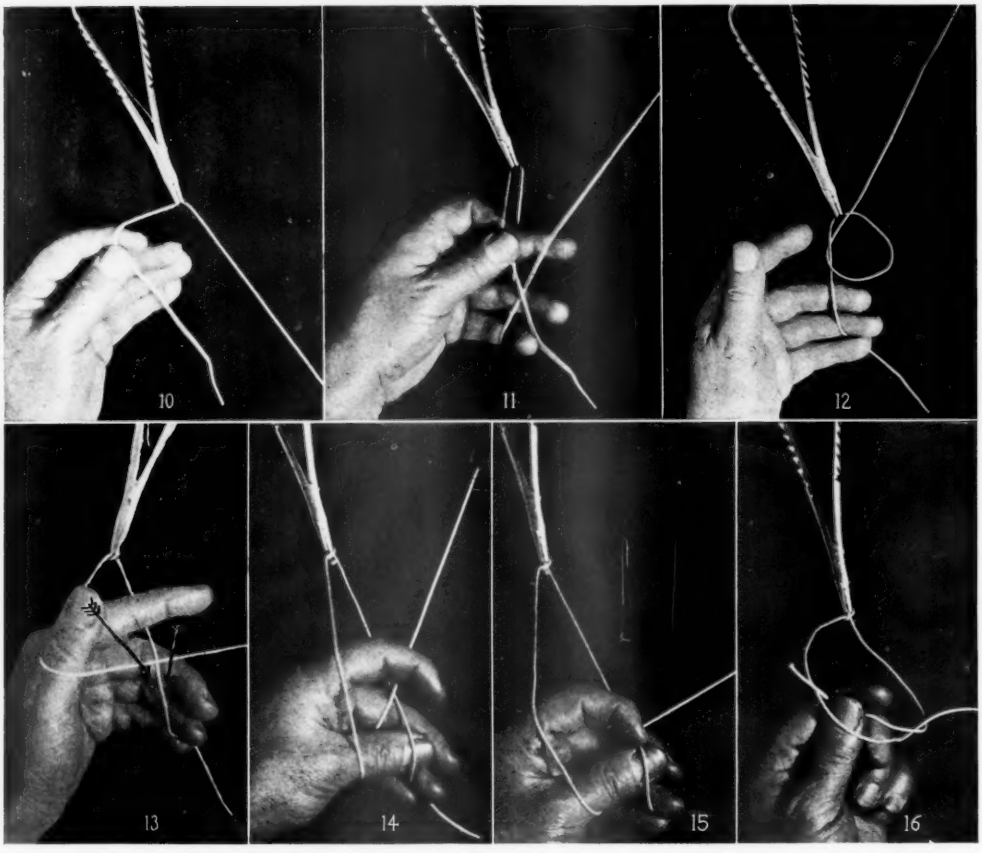


Fig. 10. Original position for the beginning of author's left hand knot.
Fig. 11. Second step of author's left hand knot. The position of the long thread and that in which the short end is placed by a twist of the hand.
Fig. 12. The short end of the thread is carried through the loop by ring and little fingers.
Fig. 13. Position for the beginning of second part of author's left hand knot.
Fig. 14. Part ii. Second step of author's left hand knot. The thumb is passed beneath the short end of the thread in the space between middle and ring fingers.
Fig. 15. The previous step continued. The short end of the thread on the thumb is grasped by the index finger.
Fig. 16. Terminal step of author's left hand knot. The short end is drawn through the loop with thumb and index fingers.

finger, the thumb is to do the work. Bend the thumb and grasp the left part of the thread on the index finger with it. When the thread is squeezed between thumb and index its end is let loose by the middle and ring finger.

Part i, step 5 (Fig. 5). Pull the left end of the thread through the loop that is formed, and draw the knot tightly.

Part ii, step 1 (Fig. 6). Hold the end of the left thread between thumb and index finger, let it run across the palmary surface and over the ring or the little finger on its way back to the knot.

The right thread meanwhile runs across the front of the middle finger.

Part ii, step 2 (Fig. 7). Middle finger moves alone, it bends and carries the right thread into the hollow of the hand past and under the left thread.

Part ii, step 3 (Fig. 8). With the back of middle

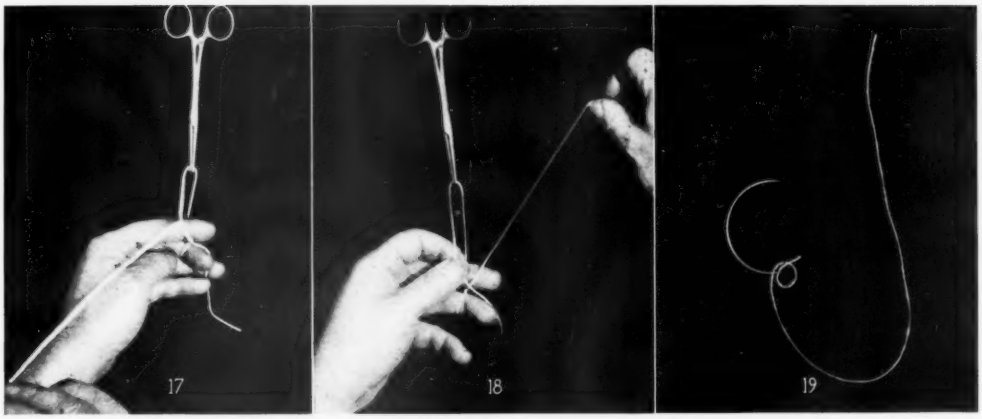


Fig. 17. Author's double knot. The short end of the thread is caught with index and middle fingers and for the second time drawn through the loop.
Fig. 18. Variation of author's knot. The long end of the thread is in the second step of part i, carried over the ring instead of over the little finger.
Fig. 19. Way of threading the gut through both eyes of a spring needle for author's left hand gut knot.

finger catch the left thread and grasp it between this and the ring finger.

Part ii, step 4 (Fig. 9). In this position (between middle and ring finger) the end of the thread is drawn through the loop and the second part of the knot tied.

The Eiselsberg knot can be tied very quickly. Its only weak point is that its first part requires considerable practice. Its second part is very easy and practical.

The author's left hand knot is to be used under the same circumstances as the Eiselsberg knot but is not meant to compete with it. My knot dates from my efforts to make the Eiselsberg knot after having seen it only from the spectators' gallery in the operating theatre. It proved useful, and as I had grown familiar and satisfied with it, I continued to employ it also after I had learnt to know the Eiselsberg knot.

Part i, step 1 (Fig. 10). Original position: Hold the left hand thread between thumb and index finger, and let the end hang down across the front of the other three fingers.

Part i, step 2 (Fig. 11). Carry the right thread down the back of the fingers, over the little finger and up again across the touching surface of fifth, fourth, and third fingers, distal to the left thread. Throw the left thread across the right and catch it between ring and little finger.

Part i, step 2 (Fig. 12). With ring and little finger carry the left end through the loop which is formed and tie the first knot.

Part ii, step 1 (Fig. 13). Position: The right thread (the short end) is held between ring and little fingers and runs across the front of ring and middle fingers and under the index finger on its way to the knot. The left thread (the long end) runs across the back of index finger and thumb.

Part ii, step 2 (Figs. 14 and 15). With the long thread on the thumb and the index finger pass the thumb beneath the short end in the space between middle and ring fingers, grasping it between thumb and index finger. At the same time let the end between ring and little finger loose.

Part ii, step 3 (Fig. 16). Carry the short end through the loop with the thumb and the index finger and tie the second knot.

The first part of this knot seems to me simpler than the first part of the Eiselsberg knot, but the second part of the latter is no doubt more handy than the second part of mine. But the reason why I have continued to cultivate my knot and describe it here, is owing chiefly to the fact, that it has one advantage over the Eiselsberg knot, namely, that it is possible to make the first part a double knot.

In order to do this alter the third step of part i. When you have pulled the short end through the loop with the ring and little finger you put the index and the middle finger through the loop again (Fig. 17), catch the end of the thread, pull it once more through and draw the now double knot tight. For the second part of my double knot the second part of the Eiselsberg knot has to be employed. The thread is after the double knot exactly in the position of step i, part ii of the Eiselsberg knot.

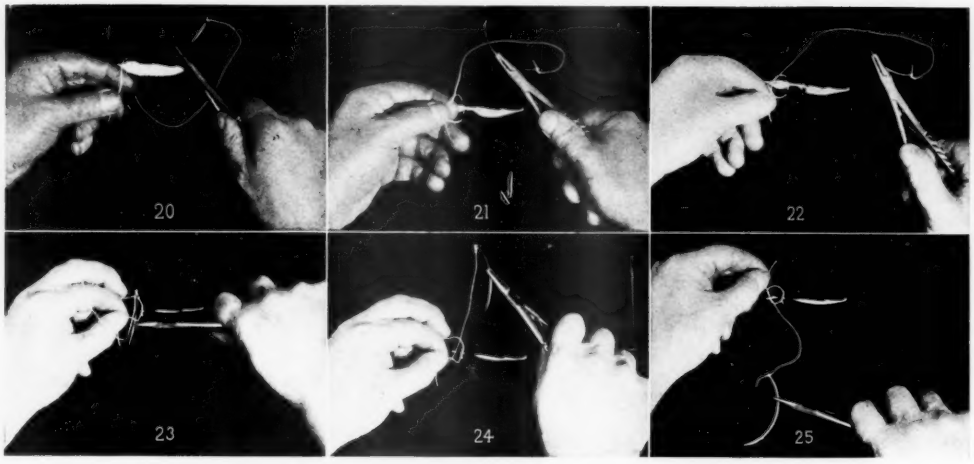


Fig. 20. How the short end of the gut is grasped to begin author's left hand gut knot, step 1.
Fig. 21. How the long end of the gut is placed between index and middle fingers.
Fig. 22. The short end of the gut is caught between thumb and index finger after having been brought through the loop by a twist of the hand.
Fig. 23. Part ii, step 1, of author's silkworm gut knot. The long end of the thread is grasped between the middle and the back of the index fingers. The needle is passed through the loop with eye end foremost.
Fig. 24. The needle is caught with the needle-holder on the distal side of the loop.
Fig. 25. The second knot is drawn tight by carrying the needle-holder back towards the operator.

By a variation, the first part of my single or double knot can be made still simpler and easier to manage. Instead of in step 2, part i, carrying the long thread round the little finger it is carried round the ring finger and the short end is caught by the middle and ring finger instead of by the ring and the little finger (Fig. 18). For the double knot the short end is caught and pulled through the loop for the second time with the thumb and index finger.

To make a series of interrupted knots with the same silkworm gut or horsehair I have for more than twenty years made use of a one-handed gut knot, which is tied with the left hand, while the right hand conducts the needle-holder and the needle. By practice it can be made very quickly, and it is moreover useful when suturing with no or little assistance.

To begin with, the gut has to be fastened to the needle. It is threaded through both the eyes of a spring needle, while the loop is laid in the cleft of the spring. Another condition is that the free end of the gut must be quite short, not more than about 1 cm. long (Fig. 19).

The silkworm gut knot. Part i, step 1 (Fig. 20). Carry the needle through the edges of the wound towards yourself, grasp the gut about 2 cm. from its end with thumb and middle finger, let it run over the tip of the index finger.

Part i, step 2 (Fig. 21). Bring the needle end of the gut in between index and middle finger.

Part i, step 3 (Fig. 22). Make a twist with these fingers and bring the end of the gut through the loop. Draw the knot tight with the thumb and the index finger.

Part ii, step 1 (Fig. 23). Pass the needle from you with its eye end foremost under the short end of the gut, which is held by the thumb and index finger. At the same time get hold of the loop between middle finger and the back of the index.

Part ii, step 2 (Fig. 24). Leave go the needle with the needle-holder and catch it again on the distal side of the loop, and pull it through.

Part ii, step 3 (Fig. 25). When the needle is through the loop, draw the second knot tight by carrying the needle-holder towards yourself. The gut must not be cut by the assistant, before the needle has got through both edges of the wound for the new suture. By the finished suture the edges are lifted in order to stretch and adapt them for the coming suture. For this knot a rather short and slightly curved needle is most suitable.

Of the two-handed knots there are a considerable number more or less rational. They can be varied

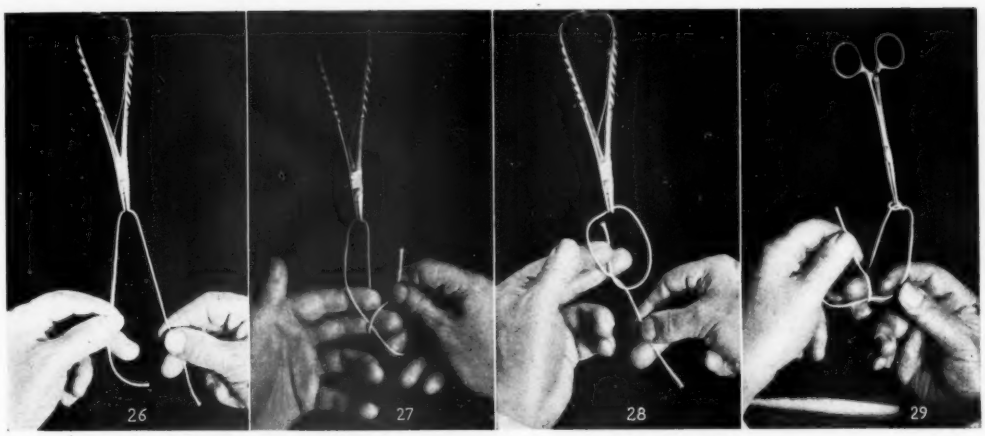


Fig. 26. Position for the beginning of the two-handed knot.
Fig. 27. Right hand thread is placed between left index and middle fingers. At the same time the left hand end is caught between right middle and ring fingers.
Fig. 28. Left index and middle fingers draw the right hand end through the loop and the first knot tight.
Fig. 29. Part ii, step 1, of the two-handed knot. Left hand end is placed between right index and middle fingers.

to much greater extent than the knots that are tied only with one hand. One of these knots may be quite as good as another, when the surgeon has become accustomed to it, and if it can be tied swiftly and safely. Nevertheless I describe the following knot, because it seems to me to surpass all others I have seen, in simplicity. This knot is undoubtedly of German origin, but I do not know the surgeon's name, which ought to be attached to it.

Two-handed knot. Part i, step 1 (Fig. 26). Hold both threads between the tips of the thumb and index and middle fingers. Both ends are in the hollow of each hand.

Part i, step 2 (Fig. 27). The right hand carries its thread over the left thread and in between index and middle fingers. During the same movement it catches the end of the left thread between the right middle and ring fingers.

Part i, step 3 (Fig. 28). Left hand pulls with index and middle fingers the end through the loop and draws the first knot tight.

Meanwhile right hand holds the thread in the original position.

Part ii, step 1. Both threads are held in the original position of step 1, part i.

Part ii, step 2 (Fig. 29). Left hand carries its thread over the loose end of the right thread and in between the right index and middle finger, while the end of the right hand thread is caught between left middle and ring finger.

The step is in every detail a recapitulation of step 2, part i, only with reversed hands. The next step is likewise a recapitulation of the corresponding step of part i.

As the free end of one thread is grasped during the same movement that places the other thread, each knot requires only one continued movement of the hands. The knot can, therefore, be tied with great rapidity and ease, and I doubt whether a better two-handed knot is to be found. A varia-

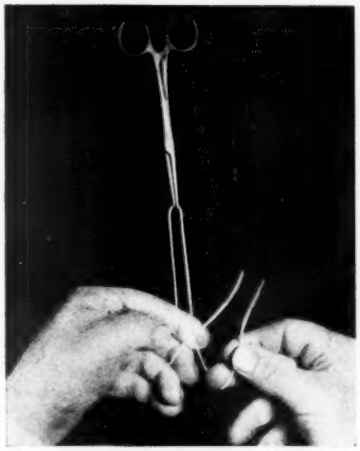


Fig. 30. Variation of two-handed knot. The ends are running from, instead of towards, the hollow of the hand.

tion of the same knot can be had by running the thread in the reverse direction across the index and middle finger tips (Fig. 30). This knot is to the beginner easier in tying, but it can not be carried out quite in the same dexterous manner.

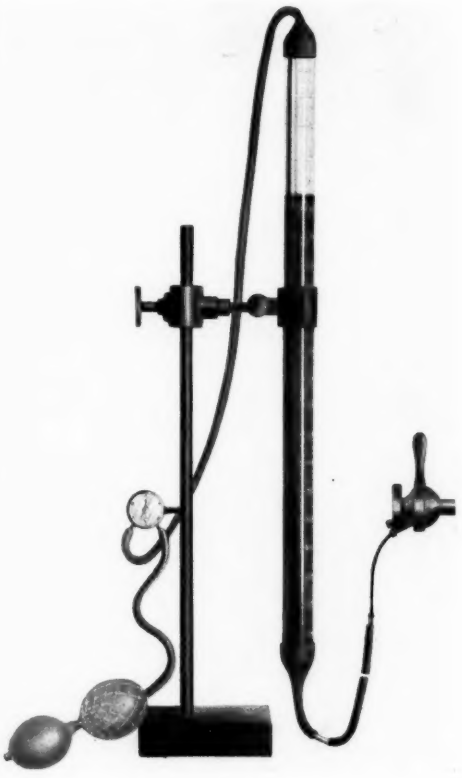
There may be many other ways of tying a good surgical knot, and these knots may possibly be simplified and improved, but the interest many of my surgical confrères have taken in the methodical tying has made me publish these ways of tying, which to me, at least, have proved satisfactory.

AN IMPROVED METHOD OF MEASURING THE CAPACITY OF THE RENAL PELVIS

By HAROLD W. BAKER, M. D., Boston, Massachusetts
Surgeon to Out-Patients, Free Hospital for Women, Brookline, Massachusetts

HAVING used the ordinary technique, so well described by Dr. F. W. Braasch[1] and Dr. Leonard Freeman,[2] for the purpose of measuring the capacity of the renal pelvis, I became dissatisfied with it for two reasons, namely: 1st. Because there was no gauge for the amount of pressure used in filling the renal pelvis, nor was there any standard for comparison. 2d. The forcing of the fluid through the catheter with a syringe is necessarily done with uneven pressure which tends to produce renal colic before the renal pelvis is filled. To obviate these faults and in order to standardize the pressure I have employed the following technique.

The apparatus, as shown in the figure, consists of a glass burette graduated into ccm. and of a 100 ccm. capacity. It is filled with sterile methylene blue solution, a rubber tube leads from the burette, which is fitted into the ureteral catheter by a glass connection, from the top of the burette a rubber tube leads to an air pressure gauge which is fitted with a cautery inflating bulb. With the ureteral catheter in the renal pelvis the bulb is inflated and the fluid is forced into the kidney pelvis under a uniform pressure. When the renal pain occurs, indicating that the kidney pelvis is distended, the reading of the pressure gauge is taken and the amount of fluid which has passed from the burette into the renal pelvis is seen at a glance.



I am indebted to my late friend and teacher, Dr. Melvin C. Millet, St. Mary's Hospital, Rochester, Minnesota, for the first suggestions which led to the construction of this apparatus.

[1] Surgery, Gynecology and Obstetrics, October, 1909.
[2] Surgery, Gynecology and Obstetrics, January, 1909.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD FEBRUARY 18, 1910, WITH THE PRESIDENT, DR. CHARLES B. REED, IN THE CHAIR

HERBERT M. STOWE, M. D., EDITOR

I. PREGNANT CORNU OF THE UTERUS. II. MISSED ABORTION. III. LARGE FIBROID

BY LESTER E. FRANKENTHAL, M. D.

The first specimen I wish to show is a pregnant cornu of the uterus, which I removed from a woman who had not menstruated for a month and a half. She then started to have irregular hæmorrhages, and on palpation a mass could be felt. On opening the abdomen we exsected the mass and sewed up the body of the uterus as one would do in the extirpation of any tubal growth of the cornu. The corpus luteum in this case was on the side corresponding to the cornu. The uterine canal is preserved in this cornu. At least twenty-five similar cases are recorded in the literature, so that the transmigration of the fecundated egg is not necessary, and fecundation may occur on the side corresponding to the cornu. As in this particular instance, on account of the oviod shape of the uterus, the low implantation of the cornu, the origin of the round ligament, the diagnosis of a cornual pregnancy seems justified.

The second specimen is one of missed abortion. The patient menstruated last on June 10, 1909, and expected her confinement some time in March, 1910. On November 1st, I was asked to see her, on account of some bleeding from the vagina, and on careful examination I found that the uterus corresponded to about a fourteen or sixteen week pregnancy, although it should have corresponded to a twenty or twenty-two week pregnancy. Her husband had some nervous lesion — a paralysis — and I assumed that there might be some specific trouble, so I gave her large doses of iodide, and she stopped bleeding. I discharged her for the time being, and did not see her until a week ago, when she sent for me for final instructions for the approaching confinement, telling me that the baby was very lively. I examined her again bimanually and found that the uterus had grown smaller than it was when last the patient was seen. I felt satisfied that the child was dead. I did a tent dilatation and easily removed the secundines with the fœtus, well-preserved, of about the eighth week of pregnancy. The fingers and toes are not developed. The head corresponds to about half the length of the fœtus. The intestines still enter the upper part of the umbilical cord, so that this woman carried this fœtus in her uterus for twenty-seven to twenty-eight weeks after its death. It must have died when it was eight weeks old and is still quite well preserved.

The third specimen is a large fibroid of the uterus which reached to within an inch and a half of the xyphoid cartilage, one and one-half inch of the axillary line, down the same distance from the vulvar orifice. The pelvis was filled with the tumor and the cervix was situated high up under the symphysis pubis. The fundus of the uterus rested on top of the tumor. The difficulty in the removal of the tumor was the ureter. Luckily, being apprehensive of this, I looked for and found a white band, corresponding to the right innominate line, on the outer circumference of the tumor. Its growth was entirely subperitoneal. I was not certain that the band was the ureter, but I was careful of it, and after having extirpated the fibroid there lay in the bottom of the pelvis this white band filled with fluid. The patient had absolutely no disturbance from the bladder nor infection, and made an absolutely uneventful recovery.

Dr. Emil Ries presented:

1. Three cases of carcinoma of the body of the uterus.

2. Multiple fibroids (one of them necrotic) associated with bilateral ovarian carcinoma.
3. Case of carcinoma of cervix.
4. Two carcinomatous glands obtained in radical operations for carcinoma of the cervix, one from a case operated on nine years ago and alive and well to-day, the other gland from a case operated on recently.

THE LEGAL AND MORAL ASPECTS OF ABORTION

By MR. SIGMUND ZEISLER

I do not claim to be a specialist on abortion. I never defended anybody in a case of abortion. and I never had anything to do with abortion, actively or passively. But having been invited to talk to you on the legal and moral aspects of the question, I have given it a little thought, and crude though my ideas may be, you are welcome to them.

The common law, which I presume you understand is the law of England as it came to us with the colonists and as it was developed in the various states of the union other than through statutory enactment, is radically different from the statutory law. According to the common law, for instance, up to the time of the quickening of the child it was not criminal to produce an abortion with the consent of the mother. Even to produce a miscarriage under any circumstances prior to quickening of the child was merely a misdemeanor. The statutory law in all the states of the United States has made abortion or the causing of miscarriage of a pregnant woman in any stage, a crime. I will confine myself to a consideration of the provisions of the Illinois statute, which reads as follows:

3. *Producing.* Whoever, by means of any instrument, medicine, drug or other means whatever, causes any woman, pregnant with child, to abort or miscarry, or attempts to procure or produce an abortion or miscarriage, unless the same were done as necessary for the preservation of the mother's life, shall be imprisoned in the penitentiary not less than one year nor more than ten years; or if the death of the mother results therefrom, the person procuring or causing the abortion or miscarriage shall be guilty of murder.

4. *Ecbolic, or abortifacient drugs.* If any druggist, dealer in medicine, or other person, sells to any person any drug or medicine, known or presumed to be ecbolic or abortifacient, except upon the written prescription of some well known and respectable practicing physician, or keeps on hand, or advertises or exposes for sale, or sells any pills, powders, drugs or combination of drugs designed especially for the use of females, without keeping the certificate as required in the next succeeding section, he shall for each offense be fined not less than $50 nor more than $500, or be confined in the county jail not less than thirty days nor more than six months, or both. *Provided*: This section shall not be construed to apply to compounds known as "Official."

5. *Certificate required.* Before any pills, powders, drugs or combination of drugs designed expressly for the use of females, shall be kept or exposed for sale or sold, the proprietor thereof shall submit under oath a true statement of the formula by which the same is compounded, to five well known and respectable practicing physicians, in the county where the same is proposed to be sold, and shall procure their certificate, signed and verified by the affidavit of each of them, that such combination is not abortifacient; and every person keeping on hand, or in such manner advertising or exposing for sale or selling such combination, shall keep such certificate, or a sworn copy thereof, with the formula attached, for the inspection of any person desiring to see the same.

6. *Advertising abortifacient drugs.* Whoever advertises, prints, publishes, distributes or circulates, or causes to be advertised, printed, published, distributed or circulated any pamphlet, printed paper, book, newspaper, notice, advertisement or reference, containing words or language giving or conveying any notice, hints or reference to any person, or to the name of any person, real or fictitious, from whom, or to any place, house, shop or office where any poison, drug, mixture, preparation, medicine, or noxious thing, or any instrument or means whatever, or any advice, information, direction or knowledge may be obtained for the purpose of causing or procuring the miscarriage of any woman pregnant with child, shall be punished by imprisonment not exceeding three years, or fine not exceeding $1,000.

What interests us the most is the first section of the statute. It is short but pregnant with meaning. It hardly needs interpretation.

"Whoever." That is to say the means may be employed by anybody — not necessarily a physician.

The words "other means" are unimportant and without meaning. This phrase has been uniformly held to include only such means as fall within the same general class as the things specifically enumerated. The means used must be an instrument, or a medicine, or a drug. In other words, and there may be some defect in the statute in this regard, if a physician should advise a pregnant woman to ride in a poor kind of vehicle over a rough road for forty miles without stopping, with the idea that that would produce abortion, and with the intent that thereby an abortion should be produced, he would not be guilty of the crime of abortion under our statute.

The next clause in the statute is "causes any woman pregnant with child, etc.," in other words, there must be established a corpus delicti. There must be a pregnant woman, on whom somebody, by the means designated by the statute, produces an abortion or miscarriage. To you that seems quite natural, but not so to the lawyer. There are statutes in some states where there is no such provision as that the woman must be pregnant with child; it has been held that a man may be guilty of abortion or the attempt to commit abortion, if he believes that the woman is pregnant with child and does what he would do, if a woman were pregnant and he intended to produce an abortion. But under our statute, differing in that respect from the statutes of many other states, it is impossible for anyone to be guilty of abortion or the crime of attempting to commit abortion — and the punishment is the same in either case — unless the woman is pregnant.

Why say "to abort or miscarry?" Why this seeming tautology? There is meaning to this. Technically, a miscarriage exists when the fœtus is expelled during the first six weeks from the time of conception; the expulsion subsequent to that time is more technically designated as abortion. Under some statutes and under the common law the production of miscarriage, technically so-called. is not a crime, and it is required that a situation exist where abortion technically, so-called, is possible. In Illinois it would not make any difference how long the fœtus has existed or how much time has elapsed from the moment of conception to make the destruction of the fœtus and its expulsion the crime of abortion.

The next clause to be considered is, "unless the same were done as necessary for the preservation of the mother's life." This does not mean that anybody could produce an abortion and escape the consequences by saying he did it because it was necessary for the preservation of the life of the mother; but this much is true, that if a reputable physician, one not known to be an abortionist, should declare under oath that he gave medicine or performed an operation to save the mother's life, little question would arise but that his act was not a crime. But the presumption is that if anybody produces abortion it is not done for the purpose of preserving human life. Of course, ultimately this is a question that must be decided by the jury in every case from all the circumstances that surround the transaction. If, for instance, the abortion has been produced by a person who advertises that he can help women in trouble, one who has been caught previously in this nefarious business, or if, perhaps, in addition to that, the victim was known to be perfectly well, no amount of swearing on the part of the one who produced the abortion that it was necessary for the preservation of the mother's life would help him with the jury. He or she would be convicted.

In this connection, an astute mind might suggest that to prevent the suicide of the mother would justify abortion in the eyes of the law. Let us suppose an unmarried woman, insane with the fear of detection of her pregnancy, threatens to commit suicide. A kind-hearted physician or a professional abortionist other than a physician, takes pity on that woman and, to save her from committing suicide, produces an abortion. This would not be a defense. It can never be told whether a woman threatening to commit suicide will do so. The law is settled that to prevent a mother from committing suicide does not fall within the clause under consideration of this and similar statutes, by which it is provided that abortion is a crime, "unless the same were done as necessary for the preservation of the mother's life."

The balance of the statute simply provides the punishment.

It is a peculiar fact, worthy of notice, that in the limited number of cases that have gone to the supreme court of this state wherein persons convicted of this crime have sought a review of the conviction — I do not think there are more than a dozen such cases — the prosecution was almost always for murder and not for abortion. The victim died. Of course, we must not judge from this that death ensues in such an overwhelming majority of cases of abortion. What we should gather from this fact is that it is difficult to catch the fellows who are engaged in this abominable business, and that the authorities ordinarily do not wake up unless the victim dies. In reading the decision of the supreme court in the Hagenow case, we find that this woman had advertised in such respectable papers as the Chicago Daily News, the

Record-Herald and the Examiner for years. The advertisements could not be mistaken by anybody. It was perfectly plain what was meant. Still the authorities never went after the woman, although there is a statute which makes such advertising without any act done pursuant thereto, punishable with imprisonment up to three years.

One other thing should be noticed which is peculiar to most statutes; that is, that there must be an intent to commit abortion before any particular act can be held to be an abortion. For instance, suppose a brutal husband beats his wife and as the result of that beating she miscarries, he is guilty of assault, but not of abortion, because he did not intend that an abortion or miscarriage should ensue.

A few words more on the subject of attempt because that is significant and important. An attempt may fail, and still it is punishable under this statute and constitutes the crime of abortion just the same as a successful attempt. For instance, if a physician should advise a pregnant woman to take ergot in large doses and she, having a very strong constitution, would not miscarry, the man who gave this advice and induced the woman to take this drug is guilty of the crime of abortion. Of course, if some ignorant person should believe that Huyler's chocolates could produce abortion, and should advise a pregnant woman to take such, although he may intend to commit abortion thereby, still he would not be guilty, because there must be some aptitude of the means employed before a man can be guilty of the attempt to commit this crime. On the other hand, suppose a man solicits a pregnant woman to take an apt medicine for the purpose of producing abortion, though she does not do it, he is guilty of an attempt to produce abortion. He has gone as far as he can; if she has not taken the advice, having the means at hand, furnished by the adviser, the latter is guilty of abortion.

One more question of interest is, Is the mother who consents, guilty of abortion? I have carefully looked at all the decisions of the supreme court of Illinois to find any light on this subject, but have failed. The statute itself would exclude the woman from guilt though she consents. It says, "Whoever causes any woman, pregnant with child, to abort or miscarry." This language does not fit the case of a woman consenting, because she would not "cause a woman pregnant with child to abort or miscarry." But we have in this state a very broad statute defining who shall be considered an accessory to a crime.

274. *Before the fact.* An accessory is he who stands by, and aids, abets or assists, or who, not being present, aiding, abetting or assisting, hath advised, encouraged. aided or abetted the perpetration of the crime. He who thus aids, abets, assists, advises or encourages, shall be considered as principal, and punished accordingly.

It is my judgment that a woman who consents and aids the abortionist in an abortion is an accessory, hence is guilty as a principal under our statute.

There is another statute under which a woman would become guilty, the statute of conspiracy, which provides that if two or more persons shall combine or conspire to do an illegal act, they shall be guilty of conspiracy. If a woman and a physician or an abortionist combine together for the purpose of producing a miscarriage on her, then they are guilty of conspiracy, she just as much he.

Of course, a person who furnishes medicine or an instrument to those who are engaged in this crime, knowing that the means will be used for that purpose, though he does not advise or in any other way have anything to do with the crime, is an accessory and under our statute is guilty as a principal.

A word as to the moral aspect. Whenever a moral question comes up for consideration, I always like to fall back on the old Kantian categorical imperative which is about as follows: "Always act thus that the motive underlying your actions may furnish the principle for a general law." Let us apply that to the abortionist or to the woman consenting to an abortion. If the motive or principle of their action were to underlie a general law on the subject, it would mean that everybody should commit abortion and every pregnant woman should allow or consent to an abortion. What then would become of this world? Somehow or other, we are egotistic enough to think that the solar system, or at least this planet, was made for the delectation of human beings. Whether we believe that or not, it so happens that the human race rules upon this planet. Human life, in spite of vicissitudes and many sad hours, is a very beautiful thing. For centuries man has worked to produce what we call civilization, although we have not reached what will ultimately be called civilization; we have only reached a certain degree of it. That the human race should disappear from this planet is a sad thing to contemplate. That anything should ever become a general practice which would result in the total annihilation of the human race, cannot be contemplated with any degree of ease of mind. Hence it is so self-evident that abortion is wrong, that it really needs no discussion from the moral point of view.

It is wrong also because it is a violent interference with a normal, natural physiological process, an interference which is fraught with danger to life, or at least to health. Anything of that sort deserves the condemnation of all right thinking people, and certainly deserves the condemnation of the law.

But there are still other reasons, and here we must distinguish between married and unmarried people. In the case of married people, if abortion were to be sanctioned, it would be an encouragement to race suicide. Race suicide is not only bad in itself, because it must ultimately lead to the depopulation of the earth, but it is wrong for other reasons. Encourage married women to kill off the fruit of the womb, encourage them not to have any children, and you will encourage them to lead a life given over to idleness and frivolities. At least in many cases women, instead of devoting themselves to the duties of motherhood, will be sitting in rocking-chairs, reading cheap novels, or going to pink teas and Kaffee Klatsches. I have the old-fashioned idea that no man's or woman's life is rounded out or becomes a complete thing, a thing beautiful to contemplate, until he or she has the responsibility for the bringing up of children, and unless he or she has the great satisfaction and delight of seeing the child they have cared for grow up and become a useful member of society. It is the only way for us to become altruists that comes easy and natural. Other forms of altruism are difficult. This is one that nature has provided and makes us better human beings.

In the case of unmarried people, to sanction abortion would be to encourage licentiousness and recklessness of conduct. Fear of detection through childbirth is most often the only deterrent. If the unmarried woman believes in free love, let her have the courage of her convictions and ignore the prejudices of the world. Let her go about carrying her head erect, proud of the condition she is in as the result of giving herself to the man she loves. If she does not believe in free love, if she has had sexual intercourse with the knowledge or feeling that it is wrong, why should she be given a chance to hide her wrong? The procreation of children out of wedlock is not a thing that agrees with our views of the needs of human society. It must not be encouraged. But the existence of the practice of abortion encourages unmarried people to indulge their passions. If pregnancy ensues, the producement of abortion is not always so easy or simple, and thus this condition results in bringing children into the world out of wedlock.

Of course, the stern attitude of society is a powerful aid to abortion. Many an innocent woman is taken advantage of by a designing man, is seduced and made pregnant. In many an unmarried woman the sexual passion is a pathologic condition. She is so constituted that she cannot help yield to the man she loves. Society anathematizes such women, and it is but natural that she should desire to obliterate the evidence of her so-called guilt. If I had my way about it, I would not have such a woman condemned. If I could do it, and others would help me, I would try to fight that prejudice which so generally and under all circumstances condemns an unmarried woman who gives herself to a man. And society is so hypocritical that we do not so much condemn the woman for yielding to a man as for the horrible crime of letting herself be found out. We ought to educate society not to cry anathema to every fallen woman, not to throw stones at them, and thus to drive them into the hands of the abortionist. We should rather inquire into the circumstances of each case, and extend indulgence, forgiveness, and helpfulness to every woman who deserves it. Unfortunately, the view of society at the present time is the reverse, and is largely responsible for the prevalence of abortion.

THE METHODS OF THE PROFESSIONAL ABORTIONIST

By RUDOLPH WIESER HOLMES, M. D.

In general it is possible to characterize the professional abortionist by the use of three words — criminality, knavery, and avarice. A man prompted to perform one transgression against the moral and civil law easily may take the downward course until his life is steeped in illegal practices. The perpetration of one criminal abortion makes the second offense less obnoxious to his ethical stamina. Fraud must be met by fraud, the rewards of crooked action must be obtained by preying upon the weaknesses of human nature, and truth must be met by perjury. So we see the man who commits an illegal abortion for some specious argument and consideration finds that he must continue his offenses, he finds soon that the rewards are uncertain, and too often inadequate to compensate for the risks at stake — as a result he feels compelled to force an excessive reward by intimidation, coercion, and even robbery. There may be professional abortionists who feel they are called to relieve the illegitimately pregnant, or the married woman who wishes to deny her maternity, and who believes they are right, and who honestly, according to their light, endeavor to treat their victims with consideration and without any underhanded methods of obtaining reward; but I have grave doubts of the actual existence of such. The career of the professional abortionist is so uncertain, the expenses incident to his practices so large, that he must make hay while the sun shines.

The criminality of the professional abortionist is not comprised in the production of illegal interruptions of pregnancy alone, but includes all machinations stimulated by his cupidity. In considering this topic, therefore, we naturally may view the question from two aspects, first, and really more important, the discussion of the frauds, chicanery, and thievery employed in obtaining a clientele and securing the rewards; secondly, the methods employed in the production of the felonious attack. The first is a discussion of warped character, the second, a consideration of obstetric surgery very badly done.

There are three kinds of abortionists: First, the young man who is inveigled into committing his first offenses in his pressing need of money, or prompted by the call of a friend in need; secondly, the physician who stands fairly well with a certain clientele, and who largely is engaged in ethical practice, but who systematically relieves his patients in order that he may hold his families; the third class comprises the professional abortionists, and is recruited by the other two, especially the second class. The discussion of the first two classes does not concern us here, but in every community there are no inconsiderable numbers who have such professional careers; they generally are members in good standing in their local and national societies; the members of the organization know of the facts by repute and actual knowledge, but are too weak-kneed to take aggressive action for their expulsion.

This is a period of trusts, not only in the commercial world, but also in the perpetration of crime; the trite old saw that "birds of a feather flock together" typified this long before a trust was known. Within the past months the daily press has repeatedly mentioned the panders' trust; so the abortionists likewise have their organization for offensive and defensive warfare. We have one very strong organization in those who formerly advertised extensively in the daily papers, and do so no more on account of the stop orders issued by the post-office department; a coterie of midwives also has its association for mutual protection; not all professional or quasi-professional abortionists are members of the guilds, but enough comprise the membership to give each a strong financial backing in cases of need. We have been informed that the legal department is strong; the members have full instruction covering the methods to be employed so incriminating evidence will not be forthcoming. They have ample defenses devised for every contingency; in the event of a prosecution the defense is ready to prove an alibi, to prove the circumstance that the statement was made before witnesses that the young woman had had an operation elsewhere, and that they had merely performed a life-saving operation, testimony is met by perjury, and too often attempts are made to influence the coroner's office, or that of the state's attorney. This influence includes that of the Masonic order, the churches, reputable men and women of every walk of life; for every exigency a rebuttal is at hand. That there is system in this is evident in that they have a headquarters which is under the direction of an efficient manager.

Until three years and more ago advertising in the daily papers was systematically carried on; some of the dailies merely printed the names, addresses, and office hours of the abortionists; others

hesitated not at giving glaring notices. Saturdays, generally, were devoted to giving display advertisements which all but announced in plain words that they were willing to perform abortions. This was done by extolling their expertness in treating female irregularities, that confinement cases were taken, and that infants were adopted. One of the papers had a solicitor out whose sole business was to look after this end of the advertising game; regularly each week he would visit the advertisers to collect the moneys due; he sought out men of shady reputations in order to secure their notices, pointed out how great was the gain, and how easily the wording could be couched to be intelligible, yet not legally obnoxious. Some years ago a detective was sent out to visit each of these advertisers; she stated she was in trouble, or at times that a friend was pregnant, and, having seen the advertisement came to see what could be done; and one only would not commit himself, and he did this because he had recently been fined, and was not looking for further trouble. It was on this evidence obtained by the Committee on Criminal Abortion of the Chicago Medical Society that prompted the post-office authorities to prohibit the use of the mails to the papers if they accepted further advertisements of this nature. The return must have been large, for some of these advertisers spend daily from twenty-five to one hundred dollars. The papers fully recognized these criminal advertisements for they charged an exorbitant rate, many times over current rate for classified space. One paper which voluntarily suppressed these notices admitted their one quarter or more of a column netted them a full $50,000 a year.

The fees of the abortionist depend upon what the market will bear. The midwife has a sliding scale from two dollars up; if the girl remains in the midwife's home it is twenty-five dollars; some few have more aristocratic quarters with a fee of seventy-five dollars and more for the operation and one week's board; thereafter, the charge is twenty-five dollars a week for board and nursing. Some of these fashionable places are conducted by midwives, or experienced if not trained nurses, and have a regularly appointed staff of physicians to do the work. Fees are almost invariably taken in advance, and then exorbitant charges are added for extras. Some of these establishments have very lucrative returns; the proprietor of one of them, for instance, informed our detective that she had to remove her telephone because so many applications came in that she had more work than she could attend to. Another establishment keeps a waiting list; some of the prospective patients remain in adjacent boarding houses for their turn.

One of the successful operators, at least as far as numbers of his victims are concerned, who is now doing time at one of our penitentiaries, robbed a girl of her jewelry; this is not of rare occurrence. Again, now and then reports would reach the committee of a young woman who would enter a maternity home; soon the people would hand out excessive sympathy, and by thus ingratiating themselves would get all the facts of the girl's downfall, her real name, the name of the young man. After the girl had gone, blackmailing letters would reach her — when she was mulcted to the limit, the attack would fall upon the young man; when both had been bled to the last extremity the letters would cease. The writer has in mind one girl, above the servant class, but who entered the family of a friend as a nurse girl with the past facts of her life made known, paid about five dollars a week for nearly a year as hush money. My friend took action when he learned of the facts, which caused an immediate discontinuation of the blackmail.

In another connection it has been stated that culpability lies not in the transgression but in the fault of discovery. This is the watchword of the abortionist. He secures his immunity from arrest by hedging himself about with safeguards. The cardinal principle of their action is never to perform an operation with witnesses present; her companion is rarely if ever allowed in the room; if discovery is made it is her word against his; if she dies he stands alone. A very popular way is for two or more operators to work in harmony; one will make all the arrangements for the procedure, and then when all is ready another will slip in and do the work. In Boston a coterie of some four or five abortionists adopted this method — the operator would enter the room masked. One of these men confided in a lawyer that he and his associates were doing something like eight hundred to a thousand a year. Some others may adopt the names of those who have retired in affluence, or by ill health or death no longer need the name. This is a very popular method, especially of the woman abortionist, physician, or midwife. In going down the street and viewing the names of two midwives at the same door or in the same window, you may be fairly morally certain that this plan is in vogue. To the knowledge of the writer only one operator used an assistant; he was a man nearly eighty years of age, who for years had suffered from an aggravated paralysis agitans; it was impossible for him to keep his hand steady enough to pass the sound into the uterus, so he had a young woman to do it for him; thereupon, catching the handle he gave the uterine

cavity a sort of vibratory massage, with such success that in 3,000 abortions he had never a failure. He met his Waterloo in his three thousand and first case — she died, and he went to the penitentiary.

In the course of the investigations of the Committee on Criminal Abortion occasional rumors of graft reached our ears. In particular one midwife complained bitterly of the drain upon her resources by the systematic grafting of public officials; how true this was is hard to determine, but from analogy with other crimes for revenue her statement probably was true; she naively added that the collector had been a friend indeed when troubles had come to her. Some years ago the Chicago papers mentioned the name of an official who was reputed to have grafted among the abortion midwives.

In connection with this woman's statement it is really remarkable the utter fearlessness with which some of the abortionists will discuss their willingness to commit illegal operations. One man discussed the question with a young man over the phone, quoted a price, named the place where the operation should be done. With hardly an exception the matter will be discussed in personal interviews with any and all who will apply; they will tell all about their methods, their successes with no failures. Some have talked with the detective of the necessity of being careful on account of the investigations going on under the auspices of the medical society, the deaths at the hands of others were commented upon; they would occasionally "knock" each other as some reputable physicians are prone to do.

We have another aspect of this question which is to the great discredit of the reputable medical profession; many of the abortionists, physicians, and midwives, have a working agreement with members of the profession, who perhaps do not do operations, except on special occasions, but who regularly assume charge of the patients after the abortion is in progress. Some of the abortionists never will see the patients after the operation; if things do not go well they either will pretend not to know anything of the party, or will refer the case to some man who will cover up the dirty work. If a death occurs and a trial is held, certain men, and well known men at that, will appear as expert witnesses, the only purpose of their presence is needlessly to befog the situation by specious argument, or even the expression of the most arrant ignorance, or tinctured with the rankest cupidity and perjury. We have in our society memberships men who are willing to demean themselves for tainted money obtained in this wise.

The methods of the production of abortions naturally follow the rules laid down in approved text-books on obstetrics for the induction of premature labor and therapeutic abortion. The method of Scheel, the rupture of the membranes, is the most popular of the physician abortionist. Some few will use a speculum, but generally the sound is passed in by guidance of the finger; the speculum is objectionable in that the hitting of the sound on the speculum creates a noise which informs the woman that instruments are used — the sound alone may be employed without her knowledge. Many disclaim the use of instruments. An essential part of the game is for the patient not to know the method employed.

Next in frequency is the passage of the catheter; this has its drawback in that the patient carries away with her the evidence which may be removed by some reputable physician.

The third method, largely restricted to the hands of the midwife, is the tent; this is not popular with the knowing ones on account of the risks of its falling into the hands of others.

The use of so-called abortifacients is generally restricted to the more ignorant midwives, who fear to use more overt method of attack; the sale of these drugs is very large. In one of the places much advertised in times past the detective found a room well stocked with boxes and bottles; in pill form the usual charge is two dollars, in liquid, reputed to be more potent, the drugs cost three dollars. Some years ago a young woman called upon me to find out if it were safe for her to go into a business of this nature which already had been established some long time. She stated the company, clear of all expenses, netted nearly a hundred dollars daily.

Many of the so-called bath parlors, hair dressing establishments, do a land office business by giving local electric treatments in the course of Turkish baths. I have in mind a number of these places where ladies are wont to congregate with each menstrual delay. Patients have told me that on taking the cure the attendant will question how long overdue they are. Some go for this avowed purpose, others have gone because they heard from friends the electric bath, locally applied, has hygienic virtues.

Irrespective of the method employed the one startling fact stands out that the professional abortionist is notoriously dirty in his work. No preliminary cleansing of the patient or the instruments is deemed necessary; sounds are taken surreptitiously from a hiding place, and passed home without regard to the risks of sepsis. This is explained on the ground that the illegal act must

be quickly consummated, to prepare the patient and the instrument takes time, and may give an observing woman the opportunity of seeing how the thing is done.

Now and then the post-mortem examinations conducted by the coroner's physician have revealed most revolting injuries of the parturient tract. It is beyond belief that anyone who has followed the career of a professional abortionist with the broad experience which some have had, should be so lacking in skill that he should rupture the vagina, make repeated perforations of the uterus, or to gouge out the entire thickness of the uterine wall for a considerable area. One physician, three times to the writer's knowledge, has produced such revolting injuries; on two occasions she brought down some feet of intestine through openings large enough to admit three or four fingers. At the trial for the third death she was given twenty years.

This paper covers superficially the topic under consideration; no one knows how many deaths have resulted from illegal operations. The 40 to 60 deaths reported each year must surely be but a fractional portion of all those who die with fictitious causes of death inscribed on the death certificate.

THE FORENSIC DIAGNOSIS OF CRIMINAL ABORTION

By MAXIMILIAN HERZOG, M. D.

We generally distinguish between abortion, which means the premature expulsion of the products of conception at a time when they are not yet viable, and premature delivery or *partus præmaturis*, which means the same occurrence at an advanced period of gestation when the fœtus is supposed to be viable after its entrance into the external world. We will not, in the following considerations, distinguish between these two varieties of premature expulsion of the embryo but will use the term abortion indiscriminately in its broadest sense, and it may here be stated that the statutory laws of the states of the Union and of European countries, as a rule, do not make any distinction as to the time of gestation when a criminal abortion was performed.

We speak of an abortion as spontaneous or accidental when it has been brought about by natural intrinsic or external accidental causes, while we speak of it as provoked or induced when it has been brought about by artificial means, employed with the object in view of a premature expulsion of the ovum and embryo. There are certain medically well-recognized indications which not only justify, but may imperatively demand the induction of premature labor. All other cases, however, where such medical indications are lacking, are looked upon by the law as criminal abortions.

The forensic diagnosis of criminal abortion has to establish two points: namely, that a gestation has been going on, and that it has been intentionally interrupted by means adapted or supposed to be adapted for this purpose. In our own country criminal abortion does rarely become the object of a forensic investigation unless the female upon whom such criminal abortion has been performed dies in consequence of it. But whether the object of a criminal abortion is alive or dead, the fact of the preceding pregnancy has to be established by objective findings and not by mere subjective statements, because these may be entirely unreliable; a woman may have some motives for simulating a previous pregnancy, or she may have been mistaken about her condition. It is a well known fact that cessation of the menses is not at all a reliable sign of pregnancy, but that a guilty conscience and purely nervous influences may be responsible for it. I have once had a chance to examine very carefully a case of this kind. A young unmarried woman, after having had intercourse with her lover, missed menstruation once. A few days after the expected flow did not appear, she took a large dose of arsenic in the form of rough-on-rats, either with the object of producing an abortion or with suicidal intent. She died from the poison within less than twenty-four hours after taking it. The coroner's physician not caring to make a post-mortem examination, I performed a partial autopsy and secured the internal genitalia. There was neither a fresh corpus luteum nor a corpus luteum verum present, the uterus was not enlarged or very insignificantly, the mucosa was not much thickened if at all, yet it presented in one place a hæmorrhagic spot which looked somewhat like the place of implantation of a very young ovum. However, a microscopic examination of the spot in serial sections and of several other places of the uterine and tubal mucosa showed that there was not the least evidence of a recent pregnancy, either uterine or ectoptic. If a careful microscopic examination of this case had not been made, it would not have been ascertained beyond a doubt that it was not at all one of an early preg-

nancy as supposed by the unfortunate young woman herself. Similar cases of missed menstruation and other signs of a supposed pregnancy in the undoubted absence of the latter have been reported by others; hence, it is to-day a principle of the law, not merely in suspected criminal abortions, but in other cases of forensic bearing, that a diagnosis of pregnancy to be fully accepted, has to be based on objective findings. In women suspected of having been recently pregnant and delivered, the objective diagnosis has to be made in the first place by a careful examination of the mammary glands, the abdomen, and the genitalia, but this is a subject to be discussed by the obstetrician and gynecologist, not by the pathologist. The latter may, in an unwilling witness, obtain some information of some value by a microscopic examination of the lochial discharges, which always shortly after delivery show numerous red blood corpuscles, some leucocytes, epithelia, and decidual cells, sometimes also fragments of degenerated villi. However, even this evidence is available only a short time after an abortion has occurred. When the latter has not led to a local or general infection or to any other more severe disturbance, and when the abortion has occurred in the earlier months of gestation, all objective signs will disappear within one or two weeks. When, however, the object of an abortion dies shortly after the latter has occurred, it is comparatively easy to establish the fact of the previous pregnancy interrupted by an abortion. But it is quite a different thing to establish that the woman came to her death in consequence of a criminal and not of a spontaneous or accidental abortion. According to the statistics of various observers, spontaneous abortion occurs in one out of every four to eight pregnant women, and these figures do, undoubtedly, not include the abortions in women during the first few weeks of pregnancy; and while criminal abortion is unfortunately very common and has been practiced extensively for many centuries among civilized as well as among uncivilized nations, it is generally only taken notice of among the former if it leads to a fatal issue. It is, therefore, impossible to give any reliable statistics but we must assume that it is much more common than it can be proven and that even of undoubted cases a very small proportion only are punished.

When an abortion is induced in a woman, not on account of well-recognized medical indications but for reasons which stamp it a criminal case, this is frequently done by incompetent persons, hastily and not in the most approved aseptic manner, safeguarding the best results as to the health and life of the woman; hence, even if a fatal infection does not occur, the products of the conception generally come away piecemeal, portions of the placenta remain behind and become the cause of long continued hæmorrhages. This induces the victims of these unskillful and criminal practices to call in skilled and reputable physicians, who even when an abortion is denied, will from objective, clinical indications, curette the uterus. I have examined hundreds of such specimens of curettage following abortion, and I have never failed to recognize the presence of villi, even if they were in an adavanced stage of degeneration. According to the common testimony of all who have seen much of this work, it is quite easy to diagnosticate a previous gestation interrupted by abortion, and we can, even from the finer details of the placental tissue draw some reliable conclusions as to the period at which gestation was interrupted. It is equally easy to diagnosticate a previous interrupted gestation from an autopsy combined with a microscopic examination taking in the whole thickness of the wall of the uterus, particularly at the original site of the placenta, which place is still recognizable a considerable time after the delivery, especially if infection has occurred, in consequence of which involution has been delayed. In making a diagnosis of recently interrupted pregnancy after a post-mortem examination, the size of the uterus and the size and character of the corpus luteum verum, combined with the microscopic examination, of the muscularis, the chorionic villi, and decidual tissue, will also enable us to draw quite reliable conclusions as to the period at which gestation was interrupted.

In the living, when parts of the embryo fall into the hands of the investigator, he is likewise often enabled, in spite of advanced degenerative changes, to fix approximately the age of the embryo from histologic details which may be still recognizable. However, it must be repeated that neither the macroscopic not the microscopic examination generally furnish evidence of the criminal character of an abortion. The latter, whether brought about by internal abortifacients, or by mechanical means, may take a course exactly like a spontaneous abortion, both may lead rapidly to a complete restitution or to a fatal septic infection. Both spontaneous and induced abortion may lead to a gradual expulsion of the products of conception with prolonged hæmorrhages, and the latter may appear in both types of abortion before the expulsion of the ovum begins, and both on the other hand, may lead to a complete expulsion of the ovum and the placenta at one time, not followed by any prolonged hæmorrhage.

While most criminal abortions which lead to a

fatal issue die of sepsis, spontaneous abortions may likewise take the same course and while there may be a strong suspicion from external circumstances in cases of abortion following sepsis, that they are due to criminal practices, this can only be proven objectively in a small proportion of cases. Haberda of Vienna reports in Schmidtmann's Handb. der Ger. Mediz., that he examined between 1895 and 1903, seventy-seven cases of fatal septic peritonitis, all of which were strongly suspected of following criminal abortion. He was able to prove this by objective findings in only nine cases. In one case there was found a perforating appendicitis; the etiology of the other cases could not be cleared up so that the criminal character of the abortions could be proved by objective findings.

In fifty-two cases of another series where there was strong suspicion of criminal abortion by the aid of mechanical means, the same author found injuries to the genitalia, including perforations, in twelve cases, in the remainder no such injuries were found, and the suspicion of mechanical interference in order to produce abortion could not be verified objectively. It is, of course, held that an abortion followed in a few days by a profound septic condition is generally mechanically induced, but this can, as a rule, not be proven, even if the sepsis has led to a fatal issue in a few days and when anatomical evidences of the mechanical interference could not have been effaced by degenerative changes. It is, however, considered an important point when it can be established by medical testimony that the symptoms of sepsis preceded the abortion. However, I am not inclined to attach too much significance to this observation. Septic microorganisms may have entered the body of a pregnant woman through the respiratory or intestinal tract, they may have been transported by the lymphatics or blood current to blood coagula in the corpus luteum, the placenta, or decidua, and may have multiplied in such a fertile, defenseless soil and this point may have become the starting point in the general sepsis, and have led to subsequent abortion without any mechanical interference in the internal genital organs having occurred.

It is now quite generally held that an abortion is rarely produced by the so-called medicinal or chemical abortifacients. If produced at all, it is simply part of a grave general intoxication. This leads to certain symptoms which may strongly suggest the particular abortifacient employed, which may also be recognized by the sense of smell, or in many cases by exact chemical tests. After the use of such abortifacients has been established, accidental poisoning must of course be excluded and the ulterior motive in their use must be shown. The steps in establishing a diagnosis of pregnancy and abortion are the same whether mechanical means or abortifacients have been employed.

We may summarize the forensic diagnosis of criminal abortion as far as it falls within the province of the pathologist as follows:

1. The diagnosis first has to establish that there has recently existed a pregnancy which has been interrupted by an abortion. This, as a rule, is a comparatively easy task, provided that the proper material — uterine curettings — can be obtained from the living or if we are dealing with a fatal case, that a proper post-mortem examination, both macroscopic and microscopic, is made. While ordinarily the microscopic examination of material from the living or dead, of tissues of the embryo, the placenta, the uterine wall, furnishes a picture easy to interpret, it may, if the degenerative processes are much advanced, occasionally tax the ingenuity of the expert student of the placenta. But this latter condition will not be frequently encountered; nor is the danger great to confound the products of a normal conception with a hydatid mole or a chorio-epithelioma malignum.

2. To establish from objective findings that an abortion has been due to mechanical means, criminally employed, is a difficult task, even in cases where a strong suspicion exists and where a fatal issue has been due to a fulminant sepsis.

3. When criminal abortion has been due to the internal use of so-called abortifacients, these may be identified by the train of toxic symptoms to which they give rise, and which will present themselves whether an abortion lead to a fatal issue or not. Most of these poisonous substances can also be identified by exact chemical tests.

4. There is no set of symptoms by which a spontaneous abortion can infallibly be distinguished from one following mechanical interference, though certain symptoms and sequelæ usually strongly point to the probability of mechanical criminal abortion.

DISCUSSION

DR. CHARLES S. BACON: It is very desirable for us to have the views of a jurist on this subject. I was particularly interested in Mr. Zeisler's discussion of the reasons for the laws against abortion. As I understand it, the laws are based on the recognition of the value of human life. Human life is something that must be preserved. But the question then arises, Why is there a distinction between fœtal life and post-natal life? In other words, Why is not feticide the same as murder,

and why should not the law recognize this by meting out the same punishment in both cases? It might be said that the law represents only the sentiment of the community and that, therefore, a law making feticide murder could not be passed, but why should we not strive for it just the same? It is a question whether it would not be more wholesome to have the law against feticide the same as against murder. If the reason for not having such a strict law as that is that it could not be enforced, the same reasoning would lead us back to the old common law. If it is better that we should strive for a law that can be enforced let us seek one that is not too strict.

The duties of the physician as a citizen in giving testimony in any case of abortion that may come under his notice are not clear to many. As a citizen, he should help to carry out the law. As a physician, the confidence of a patient is inviolable. I think it might be well to have the legal phases of our responsibility emphasized.

Another question that I would like to bring up is the one that concerned the limits of therapeutic abortion. According to the law, therapeutic abortion is recognized only when it is necessary to save the life of the mother. As a matter of fact, almost all therapeutic abortions are done to save the health of the mother. In the case of a woman with heart disease we would not expect that delivery would result in the death of the mother, but it would probably seriously injure her health. As I understand it, when we operate for any reason, except to save the mother's life, we are breaking the law. If it is right to operate for the purpose of preserving the life of the mother, it should also be right to operate to preserve her health, and the law should recognize that and not make us law-breakers.

Dr. Rachelle S. Yarros: Apparently these things have existed for many generations. Morally, we have improved somewhat, yet we still have as many abortions performed as before. We also have disreputable men performing them, and we frequently have reputable men performing them. As long as the demand is present, the supply exists. It seems to me that, as rational people, we ought to face the situation and see whether there is not a solution of the problem, whether there is not something else we might do to solve the difficulty. We do not want to encourage illegitimacy, but as Mr. Zeisler said, we are frequently far too hard in some exceptional cases. I am glad he mentioned it. We, as physicians, ought to emphasize this point very often and see what can be done. I have often thought, when these cases have come to me, that instead of taking the woman and punishing her in every possible way as the responsible person, why not also punish the man? It is probably a hard burden for her — harder than she can carry. She is punished severely, and in many cases one finds that the man at the bottom is a greater sinner than is the girl, and is more responsible. Society should in some way make him responsible, at least to the extent of having him carry the burden after making him legally the father and forcing him to support the child. I am absolutely sure that if this were done many men would not be found in that position. Many women say that if they had a little support from the man they would not think of having an abortion performed. Can we not constitutionally, and with the highest morality, in definite cases make the father responsible for the sin just as much as the mother, and if the woman is responsible when she asks for an abortion, I think that if the man who has seduced the girl knows that she will either have an abortion, or, if not, she will suffer, he should be made responsible. I think the time is coming when women will hold men responsible. Education will help a great deal more than the law. Women have hitherto been extremely ignorant on the subject of sex. It has been considered necessary for modesty's sake to keep them ignorant. The result is that they are often misled. I believe that with proper education on the subject, showing women that they are in danger of becoming pregnant and that the inevitable abortion follows, they will control themselves. I also think that education of men is of as great value. If woman is the weaker, then why should the burden fall on her?

Dr. Effa V. Davis: I was glad to hear the lawyer's exposition of the law and his discussion of the moral side. But I notice that in all discussions of this subject so little attention is paid to the rights of the child. The child is the innocent party and therefore the more sinned against. We are born with two primal instincts, that of self-preservation and that of the preservation of the race. We find that self-preservation is carried out by altruism; altruism being the refinement of selfishness. People who come to us and beg us to kill their unborn children certainly have not the finer instincts that they should have or rather they have missed the higher point of altruistic reasoning. This subject is not discussed in public as it should be, nor has it been written about consistently. We must educate the public. People should be taught what is right and just about sexual relations by such scientific data as physicians long have had at hand, but have withheld. As we have talked so much about the illegitimate child and felt so keenly that it is wronged, why should we not from now on labor to make the illegitimate a legitimate

child by making its father its real father? I believe that a child born to healthy parents in the unmarried state should constitute a marriage.

DR. EFFIE LOBDELL: Mr. Zeisler struck the keynote when he spoke of the attitude of society toward the woman and his remarks are particularly worthy of note because of the fairness in dealing with the parties concerned. It seems to me, however, that a cure will only come about when it is considered from a strictly economic standpoint, i. e., when it affects the public financially as a problem, as to-day tuberculosis is being considered.

All over the city and country are little groups of women providing temporary homes for the care of their more unfortunate sisters. We take the perfectly normal woman, give her the best of care, and she produces a beautiful normal child, but it is a social and legal outcast. That is where our arguments are weak and everything done for its welfare seems to fail — because the law which construes the case does not hesitate to discriminate against it.

It appears that we have laws enough but they should be revised or interpreted differently so that an injustice shall not be done unfortunate women and their most unfortunate children.

Dr. Yarros, Dr. Davis, and myself feel the same on this question, because our work is along the same lines. There is a statute which aims to obtain some provisions for the child from its father, where the father can be designated, but it is an easy matter to shift responsibility. The law should be altered so that any or all persons contributing through immoral relations to the dependency of a woman should be compelled to care for her and her child later.

DR. RUDOLPH W. HOLMES: Some three or four years ago we had a case in the criminal court in which the defendant was accused of producing a criminal abortion. The assistant state's attorney told me that he had carefully looked through the records and had failed to find one conviction for the production of abortion. He also informed me that in Illinois, as in most states, the woman was not a fellow conspirator, nor in any manner was she an accessory — she was merely an attacked party. Some years ago, in Wisconsin, a woman went to the abortionist and had an illegal operation; on going home and informing her husband of the fact she aroused his just indignation and resentment. A suit for malpractice was begun. At the trial the defense of the abortionist was that she consented, and consenting thereto she was equally guilty. The case went to the state supreme court which sustained the ruling of the lower court that it was no defense that she had agreed to the illegal act, and that she was an innocently attacked party. This was a civil suit. The couple recovered $5,000 damages. The case was then taken to the criminal court where the physician was convicted of producing an abortion, on his own sworn statement in the civil suit.

MR. ZEISLER (closing the discussion on his part): Dr. Bacon mentioned it as a defect in the law that we have no provision against feticide. I do not recall that there is a definite provision in the criminal code of Illinois on that subject. I presume that the legislature has been under the impression that most feticides are coincident with the producing of abortion. Of course, there may be feticide other than in the shape of miscarriage. If I am not mistaken, the common law, which in the absence of statutory provision to the contrary, would still be in force, provides that a child en ventre sa mère, is capable of being appointed administrator or executor of an estate. It is recognized as a living human being after the quickening period, and the destruction of the fœtus in any way separate from abortion is, if not a crime, at least a misdemeanor. Under the common law it was a criminal act. I think that that is still so at the present time. If it is not, Dr. Bacon is right in stating that that is a defect in the law.

I presume that the preservation of health is closely associated with the preservation of life, and where a reputable physician will consider it necessary to produce a miscarriage in the interest of the health of the mother, I am inclined to think that the law would regard that as being in the interest of life, because if health is impaired, life itself is in danger. In other words, I do not regard it as a necessary element in the defense against abortion that there should be imminent danger of death. However, that also is only an impression of mine.

Every profession has its own code of ethics, and I would not presume to dictate to physicians what professional ethics makes it their duty to do under the circumstances, just as I would resent a physician who has not thoroughly considered the matter dictating to a lawyer what professional ethics demands of him. However, I do not believe that under any circumstances a physician should consider it his business to aid in the covering up of crime, if called as a witness in court. He should not attempt to invoke any so-called privilege, but should freely tell the truth.

Some one has said that the innocent child should be regarded as an important factor. I think I have not left that out of view in my discussion of this subject. It is the child that we do consider when we say that future generations must be pro-

vided for. Of course, that might be regarded as a statement of the importance to society of preserving human life. So far as the child is concerned, the fœtus has no feeling, it has no independent existence, it has no consciousness, and therefore it is to be regarded less as an individual against whom a sin can be committed than the object through which a sin is committed against society and the interests of the human race as a whole.

It is very true that the woman, according to our code of morality, is made to bear almost entirely the consequences of the illicit intercourse between man and woman. I regard that as a great reproach to our conventional morality and to the law, and the law is very deficient in that matter. If the man can be pointed out with any degree of certainty as being the father of the illegitimate child, there is a proceeding known as a bastardy proceeding through which he can be compelled to pay to the mother for the support of that child the princely sum of fifty dollars a year for nine years. If the law should say that it does not want to provide any support for the mother, or for the child through the father of the child, because thereby women will be deterred from having anything to do with men except in the married state, there might be logic in that, but the law does provide that the father of the illegitimate child may be made to pay some support. If so, why the ridiculous sum of fifty dollars a year for nine years, and no longer? Why not provide that the child shall be an heir of the father just the same as the child born in wedlock? Why not compel the father to support the child according to his means? If not to provide any support for the unfortunate woman will deter *her* from illicit intercourse, then to provide that the father must recognize the child and make it his heir may deter *him* from illicit intercourse, and I am heartily in favor that this latter view should prevail in the law.

DR. REED: What is the attitude of the legal profession toward the doctor as an informer or as an instigator of action in cases coming under his notice?

MR. ZEISLER: I do not know what your ethics are, but speaking from the standpoint of the needs and interests of society, I should say that the physician who obtains evidence in the course of his practice of the fact that an abortion has been committed should by all means place his information immediately in the possession of the state's attorney.

DR. HERZOG (closing the discussion): I do not think that there is any necessity to continue the discussion, as far as the pathology is concerned, but I do wish to say something about the legal points which have been mentioned.

Dr. Bacon suggests that we make abortion murder. Murder, of course, consists in the killing of a human being. To look on an embryo four weeks old as a human being, seems to be an exaggerated view. Again, the law allows murder only in the act of self-defense, whether against individuals or nations. If we make the crime of abortion murder, that would prohibit the performance of an abortion under any condition, and we would have to accept the standpoint of the Catholic Church, that a living child must not be killed, no matter what the circumstances may be. It appears to me that there are unsurmountable obstacles to be considered.

Dr. Bacon also brought out the point whether a physician who gains knowledge of an abortion having been performed, and, of course, he can only gain any reliable knowledge through his own practice, should report to the state's attorney. The German law places the physician in his relation to his patient in the same position as the confessor stands to his parishioner. Everything he learns is secret and the German law makes the woman just as responsible for the abortion, whether she does it alone, or whether she consults some one and has his or her assistance. She will be punishable under every condition. The woman herself is guilty of committing or permitting an abortion. How can any physician place a case before the state's attorney when he has the full confidence of his patient, and thereby places her in the position of a criminal? That is a point to be considered, and I have spoken of it before. In my opinion whatever is confided to a physician is not to be divulged in court under any circumstances. The relations of physician and patient ought to be those of absolute confidence.

Some of the ladies have talked very feelingly about the child. There is a way of doing away with illegitimate children; that is, of doing away with the stigma of illegitimacy. It is the plan which is prevalent in Japan. There, if a man becomes a father of an illegitimate child, he adopts the child under the general system of adopting children in Japan, and takes the woman into his own household. There are no illegitimate children in Japan, and there is no stigma connected with what we would call an illegitimate child. Any decent man who is the father of an illegitimate child, who has the feelings of a father, will, I am sure, take care of the child and of its mother. And those who will not take care of them from their own impulses ought to be compelled by law to do so.

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD MARCH 4, 1910, WITH THE PRESIDENT, DR. ARTHUR DEAN BEVAN, IN THE CHAIR

ASSOCIATED PERIOSTEAL PROLIFERATION WITH DISTANT INFECTIONS

A CONTRIBUTION TO SURGICAL PATHOLOGY

BY ALLEN B. KANAVEL, M.D.

The condition shown by the X-ray plates which I here present to-night is in a way unique as far as I am aware. They are gathered from the collection of my cases of infections in the hand and other portions of the body, and seem to show a proliferation of periosteum with a deposition of salts sufficient to cast a shadow in other parts of the same hand, and also in certain cases, of the opposite hand, without any other known etiological factor except the presence of an infection of an individual finger or portion of the hand.

My attention was drawn to this pathological condition about three years ago, and since that time I have studied all my X-ray plates with great interest with the idea of either affirming or disproving this pathological sequence. Whether this condition is due to the resultant œdema or to the toxicity engendered and transferred along the nerve fibres or by other means, must be an open question. I had at first thought that it was due to the associated œdema but upon finding that the same evident proliferation appeared in the opposite hand, I have been unable to give any clear etiological relationship or pathological sequence which would bear scientific proof.

It will be seen that the cases in general present a proliferation of the periosteum of the phalanges much marked in one hand and less marked in the opposite hand. The metacarpal bones do not seem to be involved, but the irregularity of the periosteum in the phalanges in the infected cases as compared with the picture seen on the X-ray plates in which the photograph was taken for other conditions, is very evident and a distinct difference is seen.

The possibility of a syphilitic etiology was constantly borne in mind, and in all cases here presented, I think that factor can be eliminated. All the cases in which it is found have been those of acute infections with a staphylococcus, with the exception of the last case, in which a fascial tuberculosis was definitely proven by pathological examination, and a syphilitic etiology entirely eliminated.

The first patient was one with a tendon sheath infection of the index finger. This had persisted for some two months, one-half the time with a constant application of hot dressings, and when I saw the patient the distal phalanx had become necrotic. The tendon sheath was opened and the extremity of the finger amputated. This was followed by a slow subsidence of the œdema which was present.

The second patient was that of a tendon sheath infection of the ulnar and radial bursæ. Here the proliferation upon the other fingers of the hand as well as upon the opposite hand is well marked.

The third case is that of an infection of the middle finger, and here the involvement of the thumb, particularly the distal phalanx, is clearly seen. The other cases are also infections of various fingers. The last case I present, that of tuberculosis of the fascia of the middle finger, which extended for about one-half an inch into the palm, and was not as far as I could determine an involvement of the tendon sheath, shows marked proliferation from all the periosteum of the fingers of the same hand and a slight proliferation on those of the opposite hand. Why this should appear in an infection in which we always expect to find an atrophy rather than a hypertrophy of bone, is especially puzzling.

VEIN SUTURE

By H. M. RICHTER, M.D.

In regard to the subject of vein suturing a great deal has been done in the last few years and I have nothing new to offer, but rather wish to speak of some work that has been done by others and some I have carried out.

A few weeks ago Guthrie reported the use of human hair for suturing veins. A number of different methods have been used in the suturing of veins and among the simplest and at the same time the best are the various methods by ordinary straight cambric needle, with fine-sized silk. We had been using very fine sizes, size 3 O of the ordinary form of twisted silk and also in the form of untwisted strands. The silk has been used in various ways. Most of the writers on the subject have advised adding one of several different things that are a little out of the ordinary in the way of preparation of the material for suturing. For instance, in the matter of sterilization of the silk, it has been suggested that we sterilize the silk in oil in order to lessen the amount of traumatism, I suppose, to the intima of the vein and to lessen the likelihood of thrombosis around the silk where it necessarily punctures a vein. My vein work has been purely incidental to other work and was not carried out with the idea of doing vein work in itself. In my work I started in to use size 3 O silk, and the finest cambric needles which I could get, size 12. Sterlilizing in oil was a little difficult to carry out in connection with the laboratory work, and I soon found by boiling the silk in water, as I would for ordinary surgical purposes, I could get practical results, that is, the damage done to the intima and the danger from thrombosis seemed to be no greater by simply boiling the silk than by sterilizing in oil. I thread my needles, and baste them into a piece of gauze after the method W. S. Halsted has suggested for intestinal work.

Guthrie's suggestion to use human hair seems to me to be a good one. It seems to me that human hair, if strong enough, should do very well. It is very smooth. If you use straight hair — and even wavy hair is not objectionable — it can be threaded much more readily than silk in the fine needles that are necessarily used. So I started in to use this method. Guthrie in reporting the use of human hair advises the sterilization of the hair in oil, and in fact describes that method of sterilization. I began to use hair boiled in the ordinary manner in water and I find it can be boiled readily, and it will retain practically the same degree of strength after being boiled that it had beforehand.

As regards the strength of the suture material, we have always found that by a little care we can use any suture material that is of use in surgery. For instance, catgut, if we take care in using it, the strength of the material is no longer any great factor. We see men using size 3 and size 4 catgut, but most men to-day are not using that. Most men are able to get along with fine catgut and get all the strength out of it they want. When a strand of catgut gives way it is the manner in which it is knotted rather than the weakness of the catgut. In using human hair, which has previously been boiled in water and threaded in a piece of gauze, as we do with intestinal sutures, I have employed it a number of times in vein work and in order to test its strength in doing some intestinal and stomach work in making an extra stomach pouch, I have used human hair and find it to be very strong. I have not broken human hair in any work I have done.

As to the objections to the use of human hair, the first was that the size of the needle was such as possibly to leave an opening that the hair would not fill. By the hair not filling the opening there might result leakage which in vein or vessel work would be bad. Practically, by using size 12 needle, I found that objection did not hold. There is no leakage from the punctured wound caused by that sized needle. By releasing the clamp on the distal side of the line of suture we can easily avoid having leakage occur. When any leakage occurs, if it is simply left alone, in the course of a fraction of a minute the leak will cease.

As to the appearance of the line of suture from within the vein, in just a few days the suture material, whether you use silk or hair, is covered over by epithelium.

DISCUSSION

Dr. A. J. Ochsner: I have sutured the larger veins a good many times with very fine silk, with very fine needles, without unusual preparation, and I believe that Guthrie's suggestion of the use of human hair is a good one, and I am going to use it whenever an opportunity presents itself. It is not nearly so difficult to use it in suturing large veins as one would suppose. In the small veins I have never attempted it because I have never injured small veins sufficiently to require suturing, and in the animal I have never sutured a small

vein, so that I am not personally in a position to speak of it in that regard, but when I read Guthrie's paper I made up my mind I would try human hair the next chance I had.

DR. FREDERIC A. BESLEY: I would like to ask Dr. Richter if there is any danger in suturing large veins from air embolism.

DR. RICHTER: A number of years ago I attempted to demonstrate to a class the danger of air embolism, and failed to succeed in doing so because the dog would not die. I tried to pump some air into one of the superficial veins with an ordinary glass syringe, and, of course, we all know now that death by air embolism is not a very easy thing to produce by this method. It has been shown experimentally that one can inject a considerable amount of air into the superficial veins without producing death from air embolism. I think the fear of death from air embolism during surgical operations has been less by reason of these experiments. Many experimenters say they have been unable to produce death with considerable quantities of air injected into veins. In doing some experimental work on the hepatic vein in liver surgery, I produced accidentally and definitely air embolism. We could hear it all over the room. The dog died, and post-mortem examination revealed definitely all the findings one would expect in a case of air embolism. I tried it again, and found that air embolism was produced easily by making an opening in the upper part of the vena cava or in the hepatic vein; then I found by suddenly compressing the chest I could force back a large quantity of frothy blood. Several times I succeeded in having the dog live after a distinct churning sound was easily heard in the room. That is the only occasion on which I came across air embolism during experimental work, and that started with my little clamp slipping and allowing the vein to open. Embolism and death were produced by admitting a large inrush of air through an opening in a large vessel near the heart.

DR. A. J. OCHSNER: It seems to me what Dr. Richter has just said might lead those who have not had a case of air embolism to suppose that air embolism is a thing that does not happen very easily. The fact of the matter is this, that if you have seen a case or two of air embolism you are in a position to watch the occurrence of it minutely after your attention has been called to it. You will find that air embolism occurs just as it did in this dog experiment to which reference has been made. When you have a vein held open in some way, so that a larger amount of air enters the vein than is forced in by your experiment, and there is a larger amount of air in the heart than at any one time, that is what kills the dog or the patient. As was shown by the experiments of Senn years ago, you can inject a large quantity of air into a vein if you only inject a small amount of it at a time, but if you let the heart pump air instead of pumping blood, the patient will die simply because it has nothing to pump. You can pump small quantities of air through the heart and do no harm because the heart always has blood to pump with the air. In two cases I saw an accident happen just in that way. The vein was held open by a carcinoma so that as the patient inspired, she drew blood out of the deep jugular vein, the vein was wide open, and with it she inspired an enormous quantity of air which reached the heart all at one time and caused death.

DR. COLEMAN G. BUFORD: I have seen two cases in which air embolism has occurred, one when I was associated with Dr. Fenger. In this case there was a wound in the jugular or subclavian vein and the patient sucked in enormous quantities of air and apparently death was imminent, but after plugging the vessel with a wet sponge and keeping up artificial respiration for half an hour the patient survived. The same thing occurred three years ago in a case at the Mercy Hospital, the patient having been operated on for tubercular adentitis. I was enucleating the glands at the time, the patient got a leak, and an enormous quantity of air entered the vein. I did not think the patient would live. We used a wet sponge in this case with which to plug the vessel, kept up artificial respiration, the patient became more blue, and when it looked as though she was going to die we stabbed one of the veins of her arm, which relieved congestion, and she recovered.

DR. DEAN D. LEWIS made some remarks on "The Histo-Pathology of the Hypophysis."

MECKEL'S DIVERTICULUM

BY DANIEL N. EISENDRATH, M. D.

The fellows of the society will recollect that three months ago I showed a specimen of ileus due to Meckel's diverticulum, the first case I had encountered, and there have been very few cases reported in this city. I recall the case of Dr. Harsha, and one by Dr. Halstead. Dr. Halstead

reviewed the subject in the Annals of Surgery in 1902.

About two weeks ago I was asked to see a boy at midnight with Dr. Collins of this city. When brought to the hospital the boy showed all the symptoms of intestinal obstruction. According to the mother's statement, the boy had complained of frequent attacks of colic. There was no specific localization of pain. On Sunday, about forty-eight hours before the time I saw him, he complained of pain all over the abdomen and started to vomit. At the time I saw the boy his pulse was 160; the abdomen was greatly distended, so that one could palpate several coils of intestine. There was evidence of shock and it seemed an almost hopeless sort of case to do anything with, but at the urgent solicitation of the parents I went in quickly and did what I considered was a practical thing to do under the circumstances, namely, an enterostomy as quickly as possible, and not try to look for the obstruction. I saw it was an emergency case. The boy was in a bad state. I made an incision and on going into the peritoneal cavity we found enormously distended coils of small intestine. I thought the case was most likely one of intussusception. I palpated through the rectum, but could not find anything. I palpated over the abdomen and could not find any tumor, but upon palpating through the right rectus incision which I made I found a small mass which I thought was an intussusception, but after bringing it up found it was a typical Meckel's diverticulum. Unfortunately the boy died about twelve hours after the operation. After death, through my laparotomy incision I secured this specimen which shows very well the mechanism of the obstruction.

When I presented my paper I spoke of six or seven different methods of obstruction. There was one variety of strangulation in which we had a diverticular ring. We had that in this case. This Meckel's diverticulum had a terminal ligament which was fully three inches long, attached to the end of the diverticulum and inserted in the mesentery of a coil of intestines close to the Meckel's diverticulum, and beneath that three or four coils of ileum became strangulated. In addition to that, at the point where the omphalo-mesenteric vessels had originally crossed the gut to form the mesentery of the diverticulum, there was a distinct stenosis, an inch distal to the insertion of the Meckel's diverticulum itself. At that point there was complete twisting of the bowel. We had, then, a diverticulum, stenosis at the point of crossing these vessels, and a volvulus.

The treatment was much more complicated in this than in the first case. In the first case all it was necessary to do was to sever the terminal ligament from its insertion into the mesentery and I could amputate the diverticulum, which I did, and the patient recovered. This boy was in such a bad condition, however, that I could untwist the volvulus and bring the diverticulum up into the wound, which I did, and using it for an artificial anus, but the intoxication was so profound that he did not recover. Wilms in his book called attention to the fact that in ileus one must consider the condition of the diverticulum. This diverticulum is strangulated and in addition to that, there are perforations, where the diverticulum was bent so sharply on itself that it became strangulated. I took off the ileum at the ileocæcal valve.

DR. PAUL F. MORF: I understood Dr. Eisendrath to say that there were only two cases of Meckel's diverticulum reported in this city, one by Dr. Harsha and the other by Dr. Halstead. Two years ago I showed a specimen of Meckel's diverticulum before the north side branch of the Chicago Medical Society, where intestinal obstruction had occurred in Meckel's diverticulum. I saw the patient after the intestinal obstruction had existed for five or six days. The patient was almost *in extremis* and the clinical symptoms of ileus were marked. We decided to operate. The abdomen was opened and the intestine found gangrenous. The Meckel's diverticulum had become strangulated. The Meckel's diverticulum in this case was about the size and length of the phalanx of the finger. The Meckel's diverticulum had its origin near the mesenteric border of the small intestine and had coiled itself around the intestine, and its origin was near the under surface of the mesentery and it became adherent to the mesentery. After that was released we could see a distinct narrowing of the gut. The real cause of strangulation was not the Meckel's diverticulum alone, but the fact that infection in the diverticulum had occurred.

DR. H. M. RICHTER: Two or three years ago I reported a case in which Meckel's diverticulum was the only structure in an inguinal hernia. I had diagnosed the case as one of strangulated inguinal hernia. When we cut down upon the hernia we found a Meckel's diverticulum. It was not strangulated, but its distal end was gangrenous and acutely inflamed, so that the patient really had an acute diverticulitis in a hernia not strangulated, and yet from the paresis which accompanied the acute inflammation I suppose it was analogous to that which we have in ordinary appendicitis. The patient had all the evidences and findings of an acute intestinal obstruction.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

FREDERIC A. BESLEY, M. D.

GEORGE E. BEILBY, M. D. — WM. R. CUBBINS, M. D. — AIMÉ PAUL HEINECK, M. D.
WM. C. DANFORTH, M. D. — FREDERICK G. DYAS, M. D. — G. T. COURTENAY, M. D.
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ARTHUR B. EUSTACE, M. D. — JOHN A. WOLFER, M. D. — H. A. POTTS, M. D.

TUBERCULOSIS OF ASCENDING COLON AND CÆCUM

A REVIEW OF RECENT LITERATURE

BY FREDERICK G. DYAS, M. D.

REFERENCES

1. Über den isolierten tuberculosen Tumor des Colon Ascendens. Küttner, Deut. Zeitschr. f. Chir., b. 100, S. 212.
2. Ein Beitrag zur operatiren Behandlung der Tuberculose des Dünn und Dickdarms. Rubesch, Bruns Beiträge zur klin. Chir., b. lxiv, hft. 2, S. 281.
3. Über die Histogenese der Darmtuberculose. Toyosumi, Virchow's Arch. f. path. Anat. u. Physiol. u. f. klin. Med. U., 194.
4. Lehrbuch der Speciallen path. Anat,. iv Auf.
5. Surgery of Tuberculosis of the Colon. McArthur, Surg., Gyn. and Obst., vol. iii, p. 322.
6. A Case of Tuberculous Disease of Cæcum and Appendix. J. C. H. Leicester, Surg., Gyn. and Obst., vol. vii, p. 667.

NOTE.— Reference must be made to the classic monograph published in 1898 by Conrath, to which every subsequent writer has alluded: Über die lokale chronische Coecumtuberculose. Beiträge zur klin. Chir., 1898, vol. xxi, p. 1 to 110.

The typical ileocæcal tumor occurs far more commonly than any other tuberculous neoplasm of the large intestine. The practical application of this lies in the fact that tumor formations in other divisions of the large intestine are in most cases carcinomatous and furthermore the distinction between tuberculosis and malignancy of the colon, even with the abdomen opened, frequently presents great difficulties without a microscopic examination of a portion of the tumor.

Amongst Küttner's cases and from a search of the literature, no instances of circumscript tuberculosis of the ascending colon were found by him in which tumor formation was not present.

The frequency with which the ileocæcal region is attacked is attributed to the richness of the lymph supply and to the stagnation of the intestinal contents at this point. Five per cent of primary tuberculosis occurs here. Solitary follicles and Peyer's patches are first involved. Tubercles may occur in the muscularis or serosa with the submucosa unchanged. The tuberculous material is caught up by the lymph stream and carried to the lymph node.

Küttner quotes Conrath as describing two types of tuberculous ileocæcal tumors from the standpoint of pathological anatomy, viz., subserous and submucus. The subserous is the more frequent and takes its origin usually from tuberculous ileocæcal glands, leading to tumor-like accumulations of connective tissue in the subserosa. The process is intercepted for a time by the muscularis but usually leads to ulceration of the mucosa. The submucous or mucous form is less common. The pathologic changes here involve the intestinal layers in an inverse order with extensive tuberculous change and connective tissue formation in the submucosa, being limited for a time by the muscularis but finally involving the serosa.

The tumor formation does not show a tendency to caseation and liquefaction but rather inclines to formation of fibrous tissue with stenosis or obstruction of the bowel.

Küttner holds, on the basis of his observations, in harmony with Wieting, that the first implantation of the bacilli in the lymphatic apparatus of the mucosa or submucosa may occur without the presence of an ulcer. The tuberculous tumor formation is brought about by the extensive irritation of the "tuberkeleruption" to tissue production, resulting in thick intramural masses of connective tissue with copious newly formed blood-vessels, scar formation, and contraction. This scar formation causes the hardness of the resulting tumor, and finally the extensive stenosis and longitudinal shortening of the affected portion.

Küttner also believes that ulceration is secondary although it sometimes apparently stands in the foreground. It may be absent in stenosis or with more extensive tuberculous tumors. He believes further that the formation of papillæ is important for the macro-

scopic diagnosis. These drop down from the crater of the ulcer as long polypoid formations. The finding of these growths lends greater probability to the diagnosis of tuberculosis, although the polypoid formation is not specific of tuberculosis but only a manifestation of the irritation of the tuberculous process in the intestinal wall upon the mucosa.

The importance of the fact that the colon ascendens has a predeliction for tuberculous tumor formation lies less upon pathologic-anatomic than upon diagnostic and prognostic grounds. Up to the present it has been held that a tumor which involved the colon ascendens and left the cæcum free was in all probability a carcinoma and Küttner says he is convinced that many tumors which are found in museums as carcinoma of the colon ascendens, could be proven with more exact microscopic examination to be tuberculous. In one case of tumor of the colon transversum which had been regarded as a permanently healed carcinoma, he was able to demonstrate with certainty the tuberculous nature of the tumor. Such cases show the great importance of detailed microscopic examination in any case of tumor of the large intestine.

Twenty-six cases of ileocæcal tuberculosis treated at Wolfler's clinic between the years 1895 and 1906 gave the following. The immediate results were good, viz., simple enteroanastomosis having a mortality of 8.33 per cent, while resection had 10 per cent mortality. However the permanent results with enteroanastomosis are very bad, but with resection, good.

The author comes to the conclusion that with ileocæcal tuberculosis with tumor formation, the enteroanastomosis is only a palliative operation; the pathologic process being scarcely at all influenced. It is, however, indicated as a substitute for resection where the patient is too weak for the radical operation.

Surgical insult in tuberculosis of the intestine is better born than an equal amount of operative trauma for any other pathologic condition of the bowel, hence the operator is justified in many cases in making the resection which holds out the best possibilities for permanent cure.

It is important to bear in mind from the standpoint of treatment that intestinal tuberculosis in young children is usually primary, while in adults and older children it is more often secondary.

PYLORIC STENOSIS IN INFANTS

A Review of Recent Literature

By C. G. GRULEE, M. D.

REFERENCES

1. Adler. Jahrb. f. Kinderheilk., 1908, lxvii, Erganzeugsheft, 197.
2. Bernheim-Karrer. Jah. f. Kinderheilk., 1909, lxix, 551.
3. Bradley. N. Y. Med. Jour., 1909, lxxxix, 332.
4. Bunts. Trans. Am. Surg. Assn., Philadelphia, 1908, xxvi, 226.
5. Carpenter. Proc. Roy. Soc. Med., 1909, ii (Sect. Dis. Child), 182.
6. Feer. Verhandl. d. Gesellsch. f. Kinderheilk. d. Versamml. d. Gesellsch. deutsch. Naturf. v. Aertze, Köln, 1908, 125.
7. Ibrahim. Ergeb. f. inn. Med. u. Kinderheilk, 1908, i, 208.
8. Kaspar. Munch. med. Wchnschr., 1909, lvi, 1180.
9. Koplik. Amer. Jour. Med. Sci., 1908, cxxxvi, 1.
10. McClanahan. Med. Herald, 1908, xxvii, 479.
11. Machell. Canad. Jour. Med. and Surg., 1909, xxv, 222.
12. Mitchell and Oliver. Arch. of Ped., 1908, xxv, 806.
13. Nové-Josserand and Pehu. Arch. de med. d. Enfants, 1909, xii, 283.
14. Pfaundler. Jahrb. f. Kinderheilk, 1909, lxx, 253.
15. Rohn. Festschr. Hans. Chiari, seines 25 Jahr. Prof. Jubil. Wien v. Leipzig, 1908, 273.
16. Rosenstern. Deutsch. med. Wchnschr., 1910, xxxvi, 31.
17. Rothschild. Jour. de Chir., 1909, ii, 184.
18. Russell. Proc. Roy. Soc. Med., 1910, iii (Sect. Dis. Child), 78.
19. Shepherd. Montreal Med. Jour., 1908, xxxvii, 866.
20. von Starck. Zentralbl. f. Kinderheilk., 1909, xiv, 155.
21. Walls. Ill. Med. Jour., 1909, xvi, 402.
22. Weill and Chalier. Lyon. Med., 1909, cxii, 1230.
23. Wernstedt. Monatschr. f. Kinderheilk, 1909, viii, 524.

In the past few years, the question which has been uppermost has been as to the nature of this affection, whether the primary condition was hypertrophy of the pylorus or a spasm of the musculature of the stomach, or whether both conditions were at times at fault. The most exhaustive discussion of this condition is by Pfaundler.

Pfaundler first described what he termed the systolic stomach. In this condition, in the perfectly normal child at autopsy, the stomach is found to be contracted and the pylorus apparently thickened. But by removing the stomach and introducing from 50 to 60 cc. of water, the contracted state of the stomach disappears and the pylorus is found easily penetrable. After calling attention to this condition, he goes on further to examine the cases in hand. The first point which he takes up is as to whether there are cases giving the symptom complex of pyloric stenosis which show a recognized narrowing at the pyloric orifice. After reviewing the literature very completely he answers this in the affirmative.

The second question which he takes up is as to whether there are cases having the symptom complex of pyloric stenosis with organic change at the pylorus. He recognizes here three classes of cases, the first class where the symptoms are present but neither autopsy nor operation reveal the true state of affairs. The

second class is where with peristalsis and pyloric tumor, the autopsy shows a negative condition of the stomach and pylorus; and third, those cases in which the clinical symptoms of pyloric stenosis exist without peristalsis or pyloric tumor, and with negative autopsy findings.

Having given examples of these cases, he comes to the following conclusions:

First. There are individual cases whose clinical signs point to a pyloric stenosis the basis of which is an organic condition that is an hypertrophy of the stomach and especially of the anterior musculature. (Type Hirschprung.)

Second. There are cases whose clinical relations allow one certainly to assume a narrowing of the pylorus but where, however, a recognizable organic basis is completely lacking.

Third. Therefore the dietetic standpoint in the literature of pyloric stenosis in exceptions seems justified. The possibility of a close connection in the functionary and organic cases in a pathogenic respect still remains.

The views of Pfaundler are held largely by American writers, among them Scudder and Koplik, who have recently reported cases. The findings of Bernheim-Karrer would seem, however, to point to a more frequent presence of a pyloric tumor than is commonly recognized.

Of twelve cases previously seen, he had the opportunity of observing seven for a long period of time. These cases had not been treated by operation. He examined the motive capacity and the acidity of the stomach, and comes to the following conclusions:

"In a majority of the cases of pyloric stenosis in infancy seen by me, in the second or third year of life, there was a very marked absence of motility with high and sometimes very high hyperacidity. Since, in spite of this, no disturbance of the general findings, especially no signs of discomfort, had been observed, it is improbable that the conditions of spasm play a role. Pyloric stenosis due to congenital pyloric hypertrophy might exist for months or even years in the latent state." Very interesting in this connection is a case of Russell who reports an autopsy on a boy of $4\frac{3}{4}$ years who died of cyclic vomiting. From birth on, every few months, this child had attacks of vomiting which had lasted for twenty-four hours and were accompanied by epigastric pain. The autopsy showed the pyloric orifice narrowed and the musculature distinctly hypertrophied. The stomach dilated contained "a fair amount of food stuff."

These cases would seem to show that pyloric stenosis is not necessarily accompanied by pylorospasm or by continuous vomiting, and therefore would seem to raise some doubt as to the etiology of the pyloric narrowing in cases of true congenital pyloric obstruction. In this connection Wernstedt takes the view that the spastic condition is in a large proportion of the cases not the primary one. He states that as yet no case of true narrowing of the pyloric orifice has been sufficiently described to prove its existence. He also asserts that the hypertrophy of the musculature may very well be due to long inaction. He thinks that the continued difficulty of forcing food through the pyloric orifice may lead to chronic digestive disturbance which will eventually prove irreparable.

As to symptoms, three stand out, vomiting, the increased peristalsis, and the presence of the pyloric tumor. The first is always present, and the last two in a favorable percentage of cases. This variation seems to depend largely upon the individuality of the man who reports the case.

Koplik in reporting his fifteen cases, divides them into eleven cases of pylorospasm and four cases of congenital pyloric stenosis. Of the eleven cases of pylorospasm some seemed to be so mild that many physicians would probably not regard them as belonging to this group of cases. Interesting in connection with these cases, are two cases, one reported by Adler and the other by Weill and Chalier. In these cases, not only a hypertrophy of the pylorus existed, but also a hypertrophy of the musculature of the stomach, and in Adler's case the distension and hypertrophy of the stomach were so marked that there was a question as to whether the case was not one of Hirschprung's disease.

In regard to the treatment there seems to be still a distinct difference of opinion.

German writers almost without exception treat their cases without operation, while in America the case which goes without operative treatment is the exception. This is probably due to two facts. The first is the greater technical skill of the American surgeon, and the second, the fact that the German includes in his cases the pylorospasm, while the American to a great extent, confines his to the congenital pyloric type.

In regard to non-operative treatment, I have been able to find reports of fourteen cases of recovery and five deaths. (Machell, McClanahan, von Starck, Weill and Chalier, Kaspar, Koplik, Rohn.)

This series does not include thirteen cases reported by Feer in which the ultimate result is not reported, and twelve cases of pure pylorospasm reported by Koplik. In respect to non-operative treatment, the method of feeding takes a prominent position, some following Huebner's method of long intervals and large amounts, while many others follow the method of Ibrahim of very small quantities at frequent intervals.

The kind of food best suited to this condition is probably breast milk. Feer modifies this by skimming the milk and giving the child fat free breast milk.

In regard to medication, opiates are frequently applied, and Koplik used sodium citrate without marked effect. Rosenstern has reported four cases of pylorospasm in which the vomiting was favorably affected by rectal enemas consisting of:

NaCl	7.5
KCl	0.42
$CaCl_2$	0.24
Aqua	1000

As to the operative treatment, I have collected a series of twenty cases with fourteen recoveries and six deaths. By far the most important of these series is

that of Walls with eight cases and one death. (Operated by Van Hook, Murphy, McArthur and Richter.)

Other cases are reported by Bradley, Shepherd, Scudder, Bunts, Nové-Josserand and Pehu, Kaspar, Mitchell and Oliver (2), and Koplik (2).

Of these twenty cases, one was a pyloroplasty with recovery; in the case of Bradley the variety of operation is not recorded. Result death. In all the other cases, gastroenterostomy was performed.

Ten of the posterior variety with two deaths; four of the anterior variety with one death; and one in which the result was a failure, the type of gastroenterostomy is not mentioned.

It does not seem fair to judge of the efficiency of the operative treatment by statistics, because in a large number of cases operation is done as a last resort. Where operation is performed early in the disease the results are much more frequently favorable. As to the time at which operative interference should be attempted, there are as yet no criteria. Wernstedt states that in his opinion, if an operation is to be done, it should be done early, since later the damage to the intestines may be so great as to preclude all possibility of recovery.

No review of the recent literature would be complete without mention of Ibrahim's excellent and exhaustive article on this subject which has recently occurred. The attempt in this review has been to supplement this article with any subsequent facts which may have appeared.

A Method of Splinting Skin Grafts. J. S. DAVIS. *Johns Hopkins Bulletin*, 1910, vol. xxi, page 44.

Davis advocates the use of a meshed net soaked in a solution of gutta percha 15–30 parts in 150 parts of chloroform, allowed to dry and then sterilized in three changes of 1-1000 bichloride, washed in salt solution and dried; then pressed snugly down on grafted area. Overlapping edges secured by adhesion.

H. F. HELMHOLZ.

Tuberculous Cervical Adenitis; A Study of the Tubercle Bacilli Cultivated from Fifteen Consecutive Cases. PAUL A. LEWIS. *Journal of Experimental Medicine*, xii, 82–104.

To determine if possible what type of tubercle bacillus is the cause in the ordinary tubercular cervical adenitis, the writer studies fifteen consecutive cases. The material from the glands is inoculated into guinea pigs and after 3–5 weeks cultures were taken from the guinea pigs.

He describes the bovine bacillus when grown on coagulated dog serum as a short, straight, plump and solidly staining organism. The human, a longer, frequently curved, thinner and often irregular staining (beaded) organism. The human type grows as a thick wrinkle membrane from the beginning, which tends to spread rather slowly and thickens as it spreads. The bovine spreads rapidly as a thin translucent membrane.

In a summary he states that out of fifteen cases of primary tuberculosis of the cervical gland, nine were of the bovine type and six human; making his differentiation from adaptability to artificial cultivation character of growth and virulence for rabbits and calves.

JOHN A. WOLFER.

Prevention of Bleeding in Harelip Operations (La hæmostasis en la Cheirorrafia). *El Siglo Medico*, 1909.

Hæmorrhage in harelip operations may be prevented by the use of a long silk ligature with a needle on each end. By means of one needle the silk is passed through the lip from within outward at the junction of the lip with the gum and the end tied about the free edge of the lip in a slip knot, tightly enough to shut off the coronary and other vessels. The other end is passed through the lip on the other side of the cleft and tied in the same way, the middle loop or "bight" of the silk being left hanging below the chin. The constriction of the vessels allows a practically bloodless field for the paring of the edges of the cleft and the placing of the sutures, which are left untied until all are in place, when the slip knots are untied and the middle loop of the silk drawn up behind the lip as the first suture and tied; the rest of the sutures are then tied and dressings applied.

The author claims that this method allows a bloodless field without the crushing of tissues consequent on the use of a clamp.

B. J. O'NEILL.

When to Operate for Appendicitis. R. P. ROWLANDS. *British Medical Journal.*

The author strongly advocates operation at the earliest possible moment, pointing out that the many complications of the disease are preventable through thi means.

He states that interval operations are only permissible where the case has not been seen before, or has previously refused operation.

GORDON T. COURTENAY.

Resistance Produced in Mice Against Transplanted Cancer by Auto-inoculation of the Spleen. WM. H. WOGLOM. *Journal of Experimental Medicine*, xii, 20–34.

On the basis that the blood of one mouse inoculated into another produces a refractory condition to the inoculation and transplantation of tumors and since he is unable to obtain any quantity of blood from mice, the writer conducts a series of experiments using the spleen instead of blood. His object is to come to some conclusion regarding the value of this procedure. He removes the spleen from the animal and makes an emulsion of it by cutting it in fine parts with a pair of scissors. He then takes a series of mice of approximately the same age and weight and inoculates half of them with this emulsion. Twelve days later he inoculates all of the mice with particles of an adenocarcinoma. The inoculation in each instance being in the axilla. Of those inoculated with the spleen emulsion 71 per cent developed cancer, of the others 69 per cent developed cancer. Experiments are still under way but the writer says "the protective action produced by homologous undamaged spleen was completely abolished."

JOHN A. WOLFER.

BOOK REVIEWS

SURGERY AND PATHOLOGY OF THE THYROID AND PARATHYROID GLANDS. By A. J. Ochsner, M. D., and R. L. Thompson, M. D. St. Louis: C. V. Mosby Medical Book and Publishing Co., 1910.

The authors appropriately dedicate their book to Dr. Charles H. Mayo in "recognition of his splendid work in the development of thyroid surgery in America."

The chapter on pathology includes a description of the well established pathologic lesions, illustrated by excellent microphotographs from Dr. L. B. Wilson of the lesion in Graves' disease and colloid goiter.

In the chapter on diagnosis, the symptoms were grouped as major, minor, and immaterial, a valuable arrangement and one that might be used to advantage in many other clinical descriptions. This very common error of undue stress on minor symptoms has been nowhere more conspicuous than in the undue emphasis put upon the eye symptoms in Graves', the author has shown the relative value of the symptoms.

On page 41 the author states that on "the presence of tachycardia together with even the slightest degree of exophthalmos or enlargement of the thyroid gland, a positive diagnosis of exophthalmic goiter can always be made." The description of the clinical manifestations of the disease and the method of diagnosis are given with the clearness and the clinical insight which characterizes Dr. Ochsner's writings on other clinical subjects, especially his masterly studies on acute appendicitis. The danger of using thyroid extract in Graves'— a too common error — is wisely emphasized. The chapter on diagnosis is especially strong and will undoubtedly prove useful.

In the chapter on treatment of simple goiter, the treatment by injecting directly into the substance of the gland 90 drops of a 5 per cent solution of carbolic acid is especially recommended. In the one on surgical treatment of Graves', rest and diet and the use of hydrobromate of quinia and Beebee's serum are conservatively commended.

One of the most important features of the description for the operation of goiter is the specific direction for the proper administration of the anæsthetic. These directions should be quite as useful in other operations as well. If the book contained nothing more than this description, its publication would in my opinion be amply justified.

In summing up the indications for operation in Graves' disease, the author makes the following statement: "Whenever improvement in these cases from hygenic, dietetic, and medicinal treatment, together with rest is only of temporary duration, then operation is strongly indicated." * * "The recovery after surgical treatment will be much more perfect if the operation be performed before the heart and other organs have suffered severely by these recurrent floodings of the circulation with thyroid poison." In the cancer of the thyroid, the author believes that cure is rarely effected when sufficiently advanced to permit a correct preoperative diagnosis. The cured cases are, for the most part, those early cases in which the disease was not suspected at the time of operation.

In the concise and clear description of the operative technique Kocher's classical work is closely followed. The illustrations are clear, and well chosen, but many readers will probably wish that they had been placed a little more conveniently in relation to the text, or grouped together at the end of the chapters they illustrate. The difficulty of dealing with the prognosis in a statistical manner was very properly pointed out. The author believes that there are all degrees of recovery, and, at all events so many factors enter into the result that have nothing to do with the treatment, whether medical or surgical, that the value of statistical treatment is relative. The author states that the cytolytic serum of Beebee and Rogers is most effective in the earlier stages of the disease and he has not found the Moebius serum useful.

Those who are familiar with Dr. Ochsner's clinical work are aware that he is not only an expert psychologist but a philosopher as well. This is disclosed in his discussion of the social relation of the post-operative patient to the prognosis.

In the closing chapter heredity is discussed. The text of this chapter is illustrated by several striking photographs. Dr. Ochsner has planned the volume in accordance with the spirit of the times in including the point of view of the laboratory by associating with him Dr. Ralph L. Thompson, of the University School of Medicine of St. Louis, who contributed the chapter on the pathology of the thyroid in part one and all of the second part of the book dealing with the parathyroid glandules. This is a just tribute by an eminently practical surgeon to the great role now played by experimental medicine. In their preface the authors very justly state "an apology for the compilation of the main facts regarding the parathyroid glandules here presented in not necessary. These vital organs have been too long neglected both in medical text-books and in medical teaching." In this chapter Dr. Thompson has performed the arduous task of summarizing all the work of value reported in the literature, and has given an account of his own important researches. The historical account is interesting. The description of the anatomy, histology, and pathology is complete, clearly presented, and is beautifully illustrated.

Under pathology, cysts and tumors are especially described. The discussion of the relation of parathyroid glands to post-operative tetany is especially interesting. Then follows a discussion of the relation of

parathyroid glands to medical tetany, and finally a chapter on parathyroid therapy. A careful study of these chapters will amply repay every physician and surgeon. While our knowledge of the function in diseases of the parathyroid, as well as of the thyroid, is still far from being completed, there are at present many useful facts known, and still more suggestions are given for future lines of investigation.

On the whole, the authors have given us a judicial summing up of our present knowledge of the normal and the pathologic physiology and histology of the thyroid and parathyroid glands and have effected an excellent blending of clinical and experimental medicine.

GEO. W. CRILE.

A book which "takes stock" accurately of a living subject is a pleasant base-line in our wanderings through the *Index Medicus*. If we have confidence that it has dropped the errors as well as condensed the verities of the current literature, thereafter for ordinary purposes, we begin our studies with it and analyze only what is published later.

Such a book we have much needed for our knowledge of the thyroid gland, and perhaps, even more so with respect to the parathyroids. An enormous literature has grown up concerning these organs and much of it is so dissonant that there results only a noisy clangor rather than a dominant theme. Many of our troubles come from "knowing so much that isn't so." Our knowledge of the pathology of the thyroid, as well as of the treatment of its lesions, during the last five years, has seen a rapid process of elimination and simplification. Most every one now concedes that the eccentricities of the gland are explicable by the same principles which govern stimulation, over and under-functioning and degeneration of other organs. While the truth about the essential irritant in goiter probably lies buried in the *terra incognita* of the embryogeny and physiologic chemistry of the ductless glands, yet the immediate pathology of the organ is now clearly recognizable. On this a rational treatment is now based. The forbidding seven-headed dragon of thyroid surgery has become a very docile and dependable dragon, indeed, when approached with firmness, skill, *and simplicity*.

The parathyroids are much more troublesome. Just when we think we have settled the basic fact of their essential relationship to tetany, Kocher upsets our concept by preventing tetany in a parathyroidectomized dog by implanting a bit of *thyroid* in the animal's tibia. Then Thompson, Leighton and Swarts follow this up with certain experiments which suggest that even traumatic injury to the long bones may in like manner ward off tetany. At the same time, Vincent and Mrs. Thompson are adding other disturbing data by their comparative studies of the development of thyroid, parathyroid, and related tissues.

Indeed we shall probably need to know much more of the histogenesis and histochemistry of all the ductless glands before we reach the last word on their physiology or pathology. But it is well at this time to take bearings.

All this is *apropos* the appearance of Ochsner and Thompson's book on the *Thyroid and Parathyroid Glands* which is reviewed on another page. While it does not profess to give all the minutiæ of thyroid investigation, nor even of parathyroid studies, into which it goes more in detail, yet it does voice clearly the dominant theme of the current chorus.

LOUIS BLANCHARD WILSON.

THE PREVENTION AND TREATMENT OF ABORTION. By Frederick J. Taussig, M. D. St. Louis: C. V. Mosby Medical Book and Publishing Co., 1909.

This monograph embraces in its twenty-one chapters a very simple and yet comprehensive study of abortion from the standpoint of the patient, the physician, the people and the law. Being written professedly for the general practitioner, the author very wisely avoids the discussion of the more theoretical and as yet imperfectly established propositions, and confines himself to the systemization of those scientific principles and practices which experience has definitely endorsed.

His treatment of sepsis accords quite closely to modern practice, though some surgeons may take exception to the use of the gauze iodoform drain in the uterus after curettement for sepsis or incomplete abortion.

When drainage must be secured contrary to the laws of gravity the wick-like function of such a device is highly desirable but a hollow inverted organ is more likely to drain rapidly and perfectly if no obstacles diminish its channel or obstruct the outward flow.

The obstructive principle is better employed as the author advises in the various hæmorrhages which complicate these cases.

Then, too, it might have seemed desirable to include in this chapter some reference to Watkin's "laissez-faire" method of treating sepsis, since this principle can be so happily employed in every variety of medical practice whether near to or remote from the centers of light.

Besides its universal practicability it obviates in many cases those dangerous consequences of meddlesome interference which are found so frequently in consultation practice.

The author has elucidated the text by a series of tables and charts to aid in the proper appreciation of the conditions which they thus summarize.

The operative detail is intelligible, adequate, and well worked out, while the imminent danger of instrumental perforation is presented with condign stress.

In general the letter press is good, the wide margins give an attractive appearance to the page, the illustrations actually illustrate, and the style is pleasing.

The fact that the book is not burdened down and the meaning obscured by a surplusage of scientific terms makes it not only more valuable and useful to the general practitioner for whom it was intended, but it makes a more satisfactory as well as reliable companion for the specialist — however eminent.

CHARLES B. REED.

Fig. 1

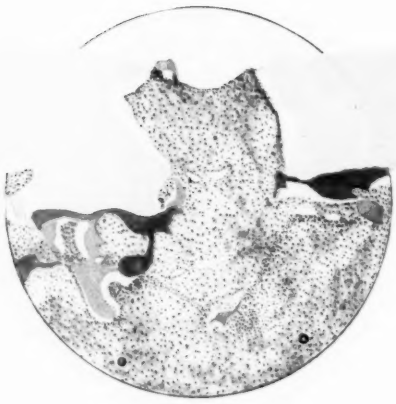

Fig. 2

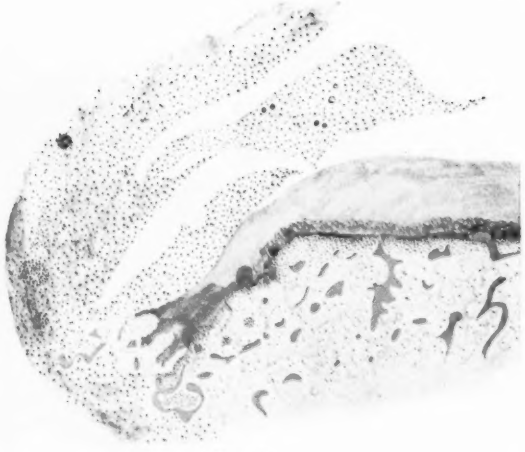

Fig. 3

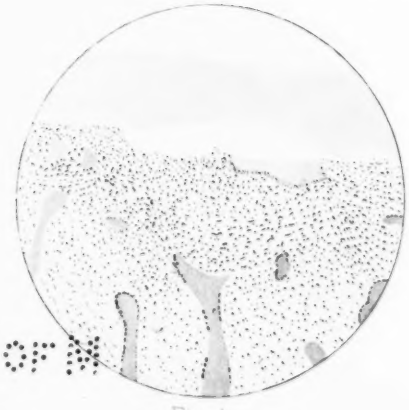

Fig. 4

Fig. 5

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